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NEW YORK, SATURDAY, MAY 20, 1905.

CONTENTS.

Editorial 921
Electric Lighting Conditions in New York 924
The United Engineering Building 924
New Subway Routes in New York 924
Programme of Canadian Electrical Association 925
Edison Interview 925
A Large Single-Phase Locomotive 925
Electric Traction at the International Railway Congress 926
Annual Meeting of the American Institute of Electrical Engineers..... 926
Electrical Engineers of the Times—X. Major G. O. Squier, U. S. A. 928
Current News and Notes 928
Hydraulic Station, La Goule, Switzerland. By F. M. Bryan 931
The Central Station Superintendent. By G. Wilbur Hubley 933
The Law of the Plunger Electromagnet. By Charles R. Underhill 934
Meter Testing for Small Stations. By A. E. Walden 935
Some Points in Selecting Fan Motors. By Howard S. Knowlton..... 936
Self-Exciting, Alternating-Current Generator 936
Alternating-Current Generator with Polyphase Excitation 937
Recent Electrochemical Developments 937
New Chicago Office of Postal Telegraph-Cable Company 938
New Telephone Patents 939
LETTER TO THE EDITORS:
The Fractional Value of π. By George L. Smith 940
Digest of Current Electrical Literature 940
Book Reviews 944
A New Pendant Switch Device 944
An Automatic Starter for Induction Motors 945
Nernst Lamp Street Lighting in New England 945
"Challenge" Primary Cell 946
"Decade" Resistance Boxes 947
Fort Wayne Induction Integrating Wattmeters 947
Variable Speed Motor Field Rheostat 948
New Westinghouse Apparatus 949
A New Type of W. H. Blake Condenser 950
Industrial and Commercial News 951
General News of the Week 953

RATES AND ENGINEERING.

Our technical readers in the field of heavy electrical engineering are more deeply interested than perhaps some of them imagine in the recent discussion and agitation in New York City over electric lighting rates. Possibly they may have wondered from time to time why we gave so much thought and space to the subject, and did not leave it to the financial organs and the socialistic journals. Unfortunately, these problems handled so very unscientifically by part of the lay press have a very vital relationship to technical questions, and we could not avoid them even if we would. To put it plainly, we do not believe that good engineering can exist and prevail where there is a bad system of rates, and that with bad engineering good rates are impossible; and we think that in the reactions here involved the whole philosophy of central station development is found. Herein lies our deep interest in such situations as have developed in New York, and while we may not approve entirely the attitude and action of the companies interested in facing attack and may have our own views as to capitalization and profits, we find ourselves compelled by the sheer logic of the situation to defend an industry suffering from prejudiced and unfair assault. In similar manner President Humphreys, of the Stevens Institute of Technology, has felt compelled to make public protest against the proposed gas pressure in the new legislation, because it demands the impossible, and deals with an imaginary evil.

In the lower price for current enacted by law in New York City—ten cents per unit—we see another effort to demand the impossible or what approaches it so closely that only engineering of the very highest type can save the situation. We have no idea what the New York Edison Company will do in the premises, but we can at least realize in some degree the gravity of the problem laid before it for solution by laws that to us smack strongly of the unconstitutional. Let us suppose the company acquiesces in the situation. It thereby not only assumes a gigantic task, but sets a standard for the whole country which must inevitably lead to a general lowering of the rate for current. Out of this condition grow one or two others of profound interest, which will, we hope, in the long run, make for the welfare of the industry, but which at the outset imply serious difficulties. Taking as an example the New York Edison Company, there is to be confronted apparently an immediate loss of income, perhaps one or two million dollars a year. But with a lower rate there should come a great new demand. How far will that go? And if it means increase of plant, can the company raise the money easily when the return on the investment is obviously predicated on a seriously lowered earning power? Here is that connection between rates and engineering to which we referred above.

The engineers of the New York Edison system have thus a task laid on them for the near future greater than any they have ever confronted before. It will mean many anxious days and nights, but we believe they will prove equal to the task. And with characteristic American optimism we think good can be seen emerging from a darkened prospect, in the expansion that may and probably will come to the whole industry from a vastly widened basis of production and patronage. In other words, we believe that this lower basis of charge for current must bring larger public demand; and though the margin of profit be dangerously narrowed the new lower rates will mean larger plants, new plants, increased mains

and feeders, old appliances and apparatus in greater demand than ever and new apparatus given an opportunity it lacked before.

AFFAIRS OF THE INSTITUTE.

It is with satisfaction we note elsewhere in our columns this week the record of the excellent work done by the American Institute of Electrical Engineers during the past year. President Lieb and the other officers and committees are to be congratulated on the activity, progress and enthusiasm shown in every department. It was a year marked by unusual effort in some quarters, such as the reception and entertainment of visitors from abroad; but this was not allowed to interfere with what may be termed the regular programme or with special effort such as that connected with the United Engineering Building. In fact, it is seen once more that activity in one direction is a stimulus on other lines also; and the whole atmosphere is enlivened. With such a membership as it now enjoys, the Institute can face the future boldly; and it is very fortunate in securing for its highest offices men of the stamp of Dr. Wheeler, to whom service to the profession through the society brings the loftiest of opportunities and gratifies the noblest of ambitions. The extraordinarily large vote cast for Dr. Wheeler is an earnest of the appreciation by the membership of long and loyal devotion and labor in the common cause.

The next thing before the Institute is the meeting at Asheville in June, and we are glad to know that already signs indicate a great success. Institute conventions are always good when held at such quiet, restful places, and the North Carolinian mountains offer many charming attractions that need in no wise detract from the amount and quality of the work done. It is moreover high time that the Southern members were given one of the opportunities of which the East has almost too many to appreciate them properly; and we believe it will help the Institute greatly as a national body thus to go South this year. It should be both a pleasure and a duty for as many members as can possibly do so to rendezvous at Asheville next month and help make this meeting one of the best and most memorable in Institute history.

COMPENSATED ALTERNATING-CURRENT GENERATORS.

At a meeting of the Manchester Local Section of the Institution of Electrical Engineers, reported in the last *Journal* of that body, a paper was read on the above topic by Mr. Miles Walker. The paper discusses the various methods in vogue for compounding alternators. No less than nine methods are considered, all of which operate upon the excitation of the alternator. That is to say, the various modes of compensation that have hitherto been used or suggested act in some way upon the field magnet windings of the alternator so as to alter the generated voltage with a view to compensating for the drop in the armature, and in order to maintain the pressure constant at the alternator terminals. The new method suggested in the paper consists in adapting the intermediate pole plan to alternators. Considering the machine as having a stator armature and rotor field, there is a small auxiliary field pole placed between each pair of main field poles and somewhat dissymmetrically. This intermediate pole is left almost unmagnetized at no load, while the main field poles are saturated. When the load is applied to the alternator, the ampere-turns of the armature tend, in general, to magnetize the auxiliary pole in such a way as to increase the armature voltage, and compound the same, so as to raise the voltage at armature terminal.

The advantage claimed for this method of compounding by armature self-excitation is that the compensation is practically instantaneous, whereas when the compensation has to be effected in an exciter which reacts upon the field current which raises the voltage, there will usually be several seconds of lag between the application of a load and the effecting of the compensation, so that the lamps connected to the system will flicker in their candle-power. One disadvantage of the system is, of course, that the compensation must necessarily be imperfect, and that it cannot adequately meet the requirements of low power factors either leading or lagging. There can be no doubt that a simple and reliable method of automatically compounding alternators is greatly to be desired. The existing methods are all more or less imperfect by comparison with those found in direct-current generators. Of course, the problem of compounding alternators is much the more difficult of the two. At the present time large central station alternators are not compounded, and their regulation is left to themselves, except as the attendant may come to the rescue by adjusting the field excitation. This is a practicable but imperfect method of controlling the pressure of a high-pressure, alternating-current system. If it were possible to compound alternators as readily as direct-current generators, the plan would be likely to come into extensive use.

Mr. Walker criticises the custom of specifying the inherent regulation of an alternator as the ratio of the rise in voltage, on throwing off the load, to the full load normal voltage. He thinks that the percentage fall in no-load voltage on applying full load would be preferable, as representing more nearly the practically existing requirements. There is, no doubt, much to be said in favor of this contention. On the other hand, however, the custom is well nigh universal of defining regulation of all properties of electric machines, such as speed, current, voltage and power, in terms of their full load condition, and it is better to be consistent in all types of machinery. It would not be desirable to have the speed regulation of a steam engine referred to its full-load condition and the voltage regulation of a direct-connected unit referred to the no-load condition. However, machines which have good regulation according to one of these definitions, would probably also have good regulation according to the other.

TURNING NIGHT INTO DAY.

There has been a great deal of unnecessary and exaggerated hostility to the utilization of Niagara Falls, a spot that many good people would like to see preserved untouched in all its pristine and awful beauty. We might share the fears of such folk were we not of the opinion that by diverting a large part of the water Niagara may be saved pretty much as it now exists, instead of being broken down by mere weight of tide into a series of low terraces and cascades, as seen already in the upper and lower rapids. The tremendous weight of the water now going over the lip of the cataract is spoiling it very rapidly, as anybody can see without a telescope. The real point at issue is not the diversion of the water—Nature may do the whole job any time at any point—but how much water it is best for man to divert. Lord Kelvin would take the lot; other less passionate lovers of the beauty of the physical universe would take less; some would take none at all; but hardly a body offers a rational reasonable suggestion as to proper limitations.

The difficulties involved in preventing folks from spoiling Mont Blanc by climbing it or the Atlantic Ocean by crossing it in steamships, are indicated by some of the suggestions presented by newspaper correspondents for dealing with the Niagara problem. One of the latest is typical and amusing. It is this: "A satisfactory compromise between the utilitarians and idealists may be effected by permitting the companies to use the full power of the Falls, say, from a half hour after sundown until sunrise; the rest of the time the waters would be allowed to flow over the Falls to their full pristine glory."

In other words, all the industries and workmen now dependent on Niagara are to change their habits and must convert the night into day by operating only between sundown and sunrise. This is delicious. It reminds one of the trial reported poetically by Cowper in which the decision was that when Nose put the spectacles on, Eyes must be shut.

THE MAGNETIC PROPERTIES OF SOME SILICON-IRON ALLOYS.

The current number of the *Journal* of the Institution of Electrical Engineers contains an interesting communication from Mr. Thomas Baker on some tests upon the mechanical, chemical, optical and magnetic properties of silicon-iron alloys. The purpose of the test was to ascertain the effect of adding silicon to iron by alloy. Five samples were produced by adding ferro-silicon in increasing amounts to clear melted Swedish wrought iron. The first sample had scarcely any silicon, the second had 1 per cent, the third 3 per cent, the fourth 5 per cent and the fifth 7½ per cent of silicon, in round numbers. The other impurities were trivial in quantity and substantially constant in all the samples. The first three samples were substantially alike in their mechanical properties. The fourth and fifth were, however, brittle and hard, being difficult to machine. It is stated that the effect of the silicon on the microstructure of iron is to increase the size of the crystals which go to make up the mass.

In order to test the magnetic properties, the samples were made up into rods 6 inches long and 0.4 inch in diameter. These were covered with a primary and secondary winding, and slipped into a yoke frame of soft iron to close the magnetic circuit. The cyclic magnetization curve was then found for each sample at a magnetizing force of 25 gilberts per centimeter. The results indicate that the permeability of the alloys increased with the silicon content. Thus at 4 gilberts per centimeter, the permeability increased from about 2,300 in the pure sample to about 2,900 in the sample with most silicon, an increase of 26 per cent, or about 3½ per cent for each 1 per cent of silicon admixture. On the other hand, the maximum induction fell from 16.25 to 14.45 kilogausses, or about 11 per cent., so that the permeability at 25 gilberts per centimeter was reduced to this extent by 7½ per cent admixture of silicon. Consequently, the permeability was increased for low magnetizations and diminished for high magnetizations. The coercive force was also reduced from 1.8 gilbert per centimeter with the pure iron to 1.0 gilbert per centimeter with the 7½ per cent silicon, so that the iron was rendered magnetically softer by the addition of silicon up to the maximum amount tried, whereas, mechanically, the iron became harder as the silicon was added. This is a case, therefore, where mechanical hardness and magnetic hardness do not increase together, as is the usual case with carbon. The hysteretic coefficient seems also to have fallen from 0.0019 to 0.0012 with the alloying, or in roughly the same proportion as the coercive force. The remanence, on the other hand, does not seem to have been greatly affected, being roughly 50 per cent. in most of the samples. It seems strange that the addition of 7½ per cent. of silicon to iron, thereby reducing the iron contents to 92½ per cent, should make the permeability 26 per cent greater at low magnetizations and reduce the magnetic hardness 44 per cent. We are so accustomed to find these properties deteriorated by small admixtures of uncombined carbon that relatively large adulterations of silicon surprise us when they affect improvement. The effect of silicon in reducing the hysteretic losses in iron has, however, been known, we believe, for some time.

A EUROPEAN TRANSMISSION PLANT.

The power transmission plant of La Goule, described elsewhere in this issue, reminds us of the late Lewis Carroll's "Through the Looking Glass." Every essential item of its design strikes the engineer at first glance as eccentric, until he falls to wondering whether it would not have been possible to put the turbines at the tops of the shafts and the generators under water below them. Even the kind of work here undertaken in supplying many small motors over a considerable territory is unfamiliar to American eyes, mainly perhaps because America has precious few small industries left to preserve. Excepting the electrical industry and some others requiring a high grade of skill, the American manufacturing ideal is to build up garish clumps of brick barracks, with outlying shanties, and fill them with Bushmen or Patagonians or anything else that will work cheaply for long hours. But Switzerland is, as every traveler knows, the home of small industries, for the preservation of which cheap electric power is of very great importance. This plant at La Goule presents really a typical case of scattered distribution, and as one examines the details of the plant something of the strangeness disappears, although there are still many striking variations from what is here ordinary good practice. The hydraulic development itself presents no very striking features. The available head is a good one, and is utilized in wheels of ordinary construction, the only unusual touch being the choice of the vertical shaft form, which may, however, have been caused by some topographical reason not apparent.

Given the vertical shaft turbine, the vertical generator is a logical necessity. And one must remember at this point that the vertical shaft generator is much more used abroad than here. Our standard lines of machines are nearly all for horizontal shafts, and special machines are frowned upon diligently. Abroad, on the other hand, the manufacturer will patiently endure an amount of special work that would drive his American brother to drink, and as a result all sorts of designs get, so to speak, into stock. The first wide departure in this plant from ordinary lines of transmission practice was in the choice of single-phase apparatus, entailing the use of motors starting inefficiently and having as a rule bad power factors at most points of load. If a supply company here tried to sell power from motors which have to be worked on a loose pulley to start at all, it would meet a very cold reception. In a broad, general way, one may say something for a single-phase system on the score of simplicity, but when it comes to working a duplex system of lines for lights and for power with three-wire secondaries on the motor lines to help the poor things start at half voltage, simplicity is a misnomer. The voltage of 5,500, too, is eccentric from the American viewpoint. We have graduated from that sort of makeshift, at least for use on overhead circuits, some time since. It is too high for direct use with ordinary distributing transformers, and not high enough to save a sufficient amount of copper.

The River Doubs, from which the plant derives its power, forms a portion of the boundary between France and Switzerland and the transmission lines serve both countries. The circuits, especially near the power station, run through a wild mountainous country almost inaccessible in winter, and they have wisely been built so as to pretty nearly take care of themselves. In the mountain country the wires are carried by pairs of stout 40-ft. poles braced together in a narrow V and without cross arms. The wires are joined with strong sleeves where joints are necessary, and are strung up to stay. It strikes us that a line built after this wise should stay in service year in and year out. One really well-built line is generally better than two poorly built ones, in spite of certain popular opinions to the contrary. One of the commonest mistakes in transmission work is to pay too little attention to solid line construction. The precedents of telegraph line building are still strong, and we have seen many a blunder made by following them instead of striking out independently and putting up a structure adequate to do its work without apologies. In the matter of line building the foreigners as a rule have the best of us, at least in work at moderate voltage.

Electric Lighting Conditions in New York.

In connection with the recent agitation and investigation in regard to electric lighting in New York City, various technical points were made by the New York Edison Company which are of general interest, but which were overlooked in the hurly-burly of popular "hearings" or were studiously neglected by those who were professedly securing all the facts in the case. Two important items of the discussion are those dealing with rates, and now that a law impends fixing a 10-cent maximum, the relation of this to the past development as well as to the future is quite significant. The bearing of rates upon engineering is referred to editorially in this issue, and the subjoined data throw light on the subject.

The service from the series arc lighting systems had become less and less satisfactory, and during 1902-3-4 the city street lamps were gradually changed over to the low-tension, direct-current, enclosed arc system. In 1903 and 1904 the series arc lighting systems were operated at an actual loss, the cost of a city arc lamp of 2,000 cp. per year averaging $163 as against the price to the city of $146. In 1903, due partly to the cost of effecting these changes, the cost of the low-tension, enclosed arc lamps was $140, allowing only a small margin—less than 5 per cent—of profit. In 1904 the conditions improved somewhat, but the margin above actual cost did not allow more than a reasonable profit considering the character of the business. In the meantime most of the old, unsightly, wooden lamp-posts, prescribed by the old Board of Electrical Control for high-tension lamps, had been removed and there were substituted iron posts which are an ornament to the city streets, and which have been extensively copied by other municipalities.

In the case of the lamps on Fifth and Madison Avenues, the average cost of the service for the three years, 1902-3-4, was $166.33 per post per year. The price charged the city for this service, $182.50, is held to be surely reasonable, allowing only a fair margin of profit when the character of the business is considered.

The price of arc lamps in the Borough of the Bronx, of which there are over 1,100, was voluntarily reduced in 1902 from 45 to 40 cents per lamp per night, and a number of lamps in particular localities in the Borough of Manhattan for which the city had previously paid 50 and 45 cents per lamp per night were reduced at the same time to the uniform rate of 40 cents per night.

The history of the lighting rates in New York City for private consumers begins with the maximum charge of 22 cents a kilowatt-hour, without discounts other than those obtained through special contracts; after several years of this method of charge, the price was reduced to 20 cents a kilowatt-hour, with discounts of 5 per cent on the first $100 consumed monthly, and 5 per cent additional for each $100 to a maximum of 25 per cent on a monthly bill of $500, and of 40 per cent on a monthly bill of $1,000. But here again there was no recognition of the lowered cost to the company to supply the long-hour consumer, and no one could get a price less than 20 cents on a bill of less than $100 monthly. Again, the growth of the company was retarded by a high price on the one hand and failure to recognize the lower cost of supplying the consumer, whose use of light extended over several hours of the day as distinct from the so-called short-hour user—a restaurant or saloon illustrating one class and a residence the other. Through a study of the schedules existing in other cities, more especially at the time those of foreign countries, these principles came to be better understood here, and eventually the New York companies were led to adopt a schedule of a maximum charge of 20 cents a kilowatt-hour during only the first hour of average use of the installation, thereafter making a reduction, not because of the quantity used, which, as stated, was 5 per cent at $100, but because of better average use, of 25 per cent o . for the second hour of average use, 50 per cent. for the third and fourth hours, 75 per cent for all in excess of four hours; or, stated in the terms of the schedule itself, the charge was 15 cents for the second hour of average use, 10 cents for the third and four hours, and 5 cents for all in excess of four hours.

This was the retail rate upon the establishment of the New York Edison Company in 1901. Recognizing the benefits, existing and prospective, that had accrued to the company from consolidation, this price was voluntarily reduced to a maximum of 15 cents during the first hour as well as the second hour of average use, representing in its aggregate a reduction of nearly $1,000,000 annually upon the present revenues of the company.

The United Engineering Building.

Hale & Morse, the architects of the United Engineering Building, have filed plans with Mr. Hopper, Superintendent of Buidings in Manhattan, giving some of the details of the fifteen-story building, to cost $975,000, which Mr. Andrew Carnegie is to present to the three national engineering societies through the Associated Societies of Engineers of New York, of which Dr. A. R. Ladoux is president. It is to be erected on the large plot from 25 to 33 West Thirty-ninth Street, and immediately adjoining it in the rear will be the thirteen-story club house of the Engineers' Club, which is also part of Mr. Carnegie's gift to American engineers. The Thirty-ninth Street building will be a fire-proof edifice, 212 ft. high, with a frontage of 115 ft. and a depth of 88.9 ft. It is to be of the French Renaissance style and will be lighted by five rows of tall decorated windows, paneled in bronze. The entrance will be adorned with fine doors of decorated bronze, and will be flanked by columns supporting bronze candelabra. Three ornamental balconied doorways, with bronze doors, built just above the entrance cornice, will be flanked by statuary, and the roof cornice and its frieze will be supported by a series of engaged columns and pilasters rising from the thirteenth story.

The facade is to be of granite and limestone trimmed with terra cotta. The main floor of the building is to have a main central entrance hall, and opening off it at the corners will be the general administration office, the smoking room, reception room and a writing room.

The third and fourth stories will contain an auditorium with a balcony and having spacious promenades on the north and south. The fifth floor will be fitted with smaller assembly halls, and the sixth floor will contain a series of lecture rooms.

The seventh to eleventh floors, inclusive, will be devoted to offices as follows: Seventh and eighth floors, miscellaneous societies; ninth floor, American Institute of Mining Engineers; tenth floor, American Institute of Electrical Engineers; eleventh floor, American Society of Mechanical Engineers. The library will occupy the thirteenth and fourteenth floors. The architect is Herbert D. Hale, with Henry G. Morse as associate.

New Subway Routes in New York.

The Rapid Transit Commission, at its meeting on May 12, adopted all the tunnel routes informally chosen a week ago with the exception of that for a four-track subway in Thirty-fourth Street. The commission decided to run the new Lexington Avenue route through Thirty-fifth and Thirty-sixth Streets, as originally proposed, and leave Thirty-fourth Street as a route for an independent crosstown line or moving platform. This modification was brought about by a letter signed by Max E. Schmidt, Stuyvesant Fish and Cornelius Vanderbilt, representing the Continuous Transit Securities Company. The letter said that, subject to possible damages to abutting property owners, the Interborough Rapid Transit Company would be glad to have a moving platform on the Forty-second Street spur of the Third Avenue elevated road.

The engineers for the New York City Railway Company said they did not longer desire a four-track route through Thirty-fourth Street, but preferred the route as originally laid down, with two tracks in Thirty-fifth and two in Thirty-sixth Street, between Lexington and Fifth Avenues. The Thirty-fourth Street crosstown line will be built in two sections, one section being from the East River to Ninth Avenue, and the other from Ninth Avenue to the North River.

The commission authorized the extension of the Interborough system from the present northern terminus on the west side to Van Cortlandt Park, Mr. Bryan saying the cars would be running there in a year's time. Acting Engineer Rice said that trains would be running down Broadway to the Battery within six weeks. Mr. Rice also said that as soon as leaks were stopped in the tunnel under the Harlem in about three weeks, it would be put in operation. The Interborough Company's proposition to four-track the Second Avenue elevated track was rejected. On the four-tracking of the Fulton Street, Brooklyn, subway, a letter was read from August Belmont saying that the Interborough was willing to pay half the cost if the city would pay the cost of the connection. This offer was accepted. The city will pay $1,500,000 and the company $500,000.

Programme of Canadian Electrical Association.

The arrangements for the annual convention in Montreal June 21, 22 and 23 next are rapidly approaching completion. Secretary Mortimer forwards us the following list of some of the papers:

"Transformers," by Mr. R. T. MacKeen, Canadian General Electric Company, Toronto. "Operation of Transformers at Varying Frequencies and Voltages," by Mr. Sammett, Montreal Light, Heat & Power Company. "Induction Motors," by Mr. Burson, Allis-Chalmers-Bullock Company, Montreal. "Economy of Isolated Plants," by Mr. T. L. Aitken, consulting electrical engineer, Toronto. "Carrying Capacity of Enclosed Conductors," by Prof. R. B. Owens, McGill University. Some additional papers are also promised.

The Question Box, under the able direction of Mr. A. A. Dion, of Ottawa, will of itself be a feature of great value. Among the other features arranged for are a luncheon at the Allis-Chalmers-Bullock Company's Works, a smoking concert, and visits to the various sub-stations of the Montreal Light, Heat & Power Company. A trip to Shawinigan is also under consideration. The laboratories of McGill University will be open to inspection by the delegates during the convention.

The committee under whose direction the local arrangements are being made is composed of the following gentlemen: Messrs. H. D. Bayne, Canadian Westinghouse Company (chairman); R. E. T. Pringle, Prof. R. B. Owens, H. J. Fuller (The Fairbanks Company), C. F. Sise, assistant superintendent Bell Telephone Company; Edgar McDougall (Caledonian Iron Works), Ed. F. Sise, manager Wire & Cable Company; R. S. Kelsch, consulting engineer; Wallace C. Johnson (Shawinigan Water & Power Company), W. F. Dean (Canadian General Electric Company), Alfred Collyer (Allis-Chalmers-Bullock Company).

Edison Interview.

The New York *Sun* of Sunday, May 14, contained a four-column article, under the heading, "Edison, the Peaceful," which article represents the results of an interview with the famous inventor. The article is illustrated with three hand sketches, showing Mr. Edison in as many different attitudes.

In answer to a question as to the progress of his work on his storage battery Mr. Edison said: "My idea is to make it possible for a tonneau car for four persons to go for a hundred miles on one charge. We can do that now with heavy trucks, but the battery is too heavy for the auto for traveling. The practical limit at present is 50 miles for the tonneau."

"Very often I am asked what I am working on and how long it takes me to complete an invention. Neither of these questions is an easy one to answer. To-day I am still at work on things which I commenced fifteen years ago and are still uncompleted. Some of these are on the market, and I am making improvements, some of them the public know nothing about. I have been working away four years on this storage battery. I worked steadily for eight years on the incandescent light, and I have worked thirty-five years on the phonograph."

"A great deal of my time at present is directed toward the perfection of the phonograph."

In reply to other questions, Mr. Edison said: "The longest time I ever worked continuously was five days and five nights without sleep. That was during some of the lighting experiments. Once I worked four days and four nights—that was just before the opening of the Pearl Street station. We did not know what was going to happen; we expected something would explode when we turned on the current. Everybody said it was going to be a failure. When we turned on the current, however, it started all right, without a hitch, and ran for eight years. Insomnia? I have to laugh when people talk about that. A man came to me once—couldn't sleep, was troubled with insomnia and was terribly worried. I said, 'I'll cure you.' I put him to work on a mercury pump, kept him at it, told him he must finish it at a certain time, and as he couldn't sleep there was no excuse for his stopping. At the end of the third day we found the pump all broken to pieces and the victim of insomnia sound asleep on the ruins. Sleep is only an inheritance; if the sun should keep on shining people would get over the habit of sleep in time."

Mr. Edison, though happily married himself, evidently shares Mr. Tesla's views on the question of the marriage of scientific investigators. In reply to an inquiry as to whether, in his opinion, wireless telegraphy would become perfected, he said: "I surely do. I think the greatest setback it has ever had was the recent marriage of Marconi, but he will get over that in time and go on with his experiment. It is doubtful if he will be able to overcome the interference of other messages absolutely."

Mr. Edison seems to be satisfied with the earth as the scene of this investigation. The problem of communicating with other planets, he admits, is beyond his reach. "I limit my scientific researches below the apex of the Himalaya Mountains," he continued, "and let Mr. Tesla have all the space above that—that is his field, the field of astronomical electrics. I should say, however, that question would be settled by the telescopic lens rather than by the wireless telegraphy."

Mr. Edison then told a little of the process of invention. "It is a great lesson in the eternal law of development. My own experience, as well as that of other inventors I have talked to, is that if you get something for nothing you may be sure you are on the wrong road. If you get the result without strenuous effort, there is only one rule, apparently, to follow, and that is to cast it aside and begin all over again, for you are on the wrong path."

A Large Single-Phase Locomotive.

The delegates at the recent International Railway Congress in Washington have been touring the country. One of the places visited during the earlier part of this week was the plant of the Westinghouse Electric & Manufacturing Company, at Pittsburg, as well as other Westinghouse industries in that vicinity. In addition to the standard features of interest, a new and important item was to be noted in the shape of the Baldwin-Westinghouse single-phase locomotive exhibited on the tracks of the Westinghouse Interworks Railway. The data as to this important novelty follow:

SINGLE-PHASE LOCOMOTIVE.

Weights and Dimensions—Weight of locomotive, complete (both halves), 135 tons; total length over bumpers, 45 ft.; maximum height with trolley down, 17 ft.; size of drivers, 60 in.; distance between centers of drivers, 6 ft. 4 in.; extreme width, 9 ft. 8 in.

Equipment—6 single-phase, single-reduction motors, having a normal capacity of 225 hp each, gear reduction 95:18; induction regulator control; pneumatically operated trolley; combined automatic and straight air brakes; pneumatic sanders to sand tracks in both directions.

General Data—Trolley voltage upon which locomotive is designed to operate, 6,600 volts; voltage on motors, 140-320; draw-bar pull, 50,000 pounds, at a speed of approximately 10 miles per hour; maximum speed for which locomotive is designed, approximately 25-30 miles per hour.

Electrical Traction at the International Railway Congress.

An interesting paper on electric traction was presented at the International Railway Congress last week by Mr. F. Paul Dubois, engineer of bridges and railways, of the Orleans Railway of France. It was a very able and interesting general discussion of the subject.

In two three-wire traction systems in France the motors on the vehicle are connected on opposite sides of the three-wire system, so as to balance the demand for energy. The lines in question, which are single-track lines, have two insulated conductors, showing a difference of potential of 1,200 volts in the first case and 2,400 volts in the second; the motor cars of the Chapareillan line have two 600-volt motors in series, and the La Mure locomotives have four motors of the same voltage also connected in series.

The use of 2,400 volts in the distribution has the result of reducing the loss in the mains to one-quarter of what it is with the ordinary voltage. Thus there is already a considerable economy in the first cost of the conductors. However, this solution has its defects. In the first place, there is the complication of having two conductors at different voltages, particularly at switches and at crossings; then the motors have to be coupled up permanently in series, and consequently the "series-parallel" control has to be abandoned; finally, as there may be a difference of potential of as much as 1,200 volts between the different parts of the locomotive and the ground, there is greater difficulty in maintaining the insulation, particularly that of the motors.

The asynchronous polyphase motors have received in Europe a certain number of applications, some of them being important ones. The type generally used is the three-phase. On the Valtellina line the current is supplied at 3,000 volts, and on the experimental Marienfelde-Zossen line even at 10,000 volts. Although these motors give an interesting and advantageous solution in certain cases, they do not appear capable of general application.

Against them, in the first place, is the fact that each track requires at least two working conductors at different voltages, and even three if the track rails are not used as a conductor; the resulting complication becomes very inconvenient at switches and crossings; moreover, the maintenance of the insulation becomes more difficult. Then the polyphase induction motor is essentially a constant-speed motor; any other speeds than those near synchronism can only be obtained at the cost of rheostatic losses, or by means of more or less complicated devices, the usual one being that known as "concatenation." This latter arrangement makes it possible to obtain a good efficiency at two different speeds, but its realization is not without practical difficulties.

With motors of this type the power stations and the lines carrying the current must have a greater capacity for an equal service than with continuous-current motors, owing to the greater power required, both in order to haul trains up gradients without reduction of speed and also for starting, and again owing to the comparatively low power factor of three-phase traction systems. This increased capacity results in a corresponding reduction in efficiency, which is all the greater because it is not possible in this case to reduce the variations of load by using accumulators, so that the amount of energy consumed, other things being equal, is about the same as in the ordinary system with continuous current and transformer substations.

Hence, the cases in which the system of three-phase motors is distinctly superior are comparatively rare. It may be stated in a general way that the conditions most favorable to its use are when the lines are long, when there are long intervals between the trains and they have few stops, or when the lines have long and regular gradients, particularly if there is plenty of motive power and it is cheap; under such conditions it is cheaper both to install and to maintain than the preceding system. In the case of mountain railways, three-phase motors have another valuable advantage, which is the automatic limitation of the speed and the return of the energy to the line while running down hill, when the motors act as generators.

A much more extended field seems to be available for monophase motors which recent improvements have once more brought into notice. The only monophase alternating-current motors at present existing which have the speed and torque properties suitable for application to traction are the "commutator" motors. The question of applying motors of this kind to traction purposes has lately been taken up in several different countries simultaneously—thus in America by Mr. Lamme, in Italy by Mr. Finzi, in Germany by Messrs. Winter and Eichberg, in France by Mr. Latour. The motors tried are either of the series type with laminated poles, or of the repulsion type, or are a combination of both these types. The results already obtained raise the hope that it will not be long before there will be a monophase motor which will work satisfactorily, give a good torque at starting, a high power factor under normal conditions and an efficiency similar to that of the best continuous-current motors.

Annual Meeting of the American Institute of Electrical Engineers.

The annual meeting of the Institute was held at Carnegie Hall, New York City, on May 16, President Lieb in the chair. There was a good attendance and a number of interesting reports were presented from various committees and from the board of directors. The total membership is now 3,460, the second largest of the kind in the country, being exceeded only by the Mining Engineers, with 3,680. During the year 595 associates were elected.

The plan outlined a year ago by which certain funds were established for specified purposes has been continued, all of which, including the daily balances, are drawing interest. No change has been made in the items of $8,000 in U. S. bonds, and the Mailloux Fund of $1,000 in a certificate of deposit; the income of the latter being devoted to continuing the files of certain periodicals in the library contributed by the founder of the fund.

The ordinary receipts during the fiscal year ending April 30, 1905, were $43,130.95. This amount was made up of $33,822.19 from members, including entrance fees from association and transfer fees from members; $1,660 in students' dues, $5,765.40 from advertising sales and subscriptions, $743.89 interest and exchange, $977.75 badges, and $161.72 miscellaneous. The ordinary operating expenses of the Institute were $37,529.25, leaving a balance of ordinary receipts over expenses of $5,601.70.

The bank balance available for current expenditures on April 30, 1905, was $11,054.31. Adding this sum to $8,875.63, the market value of the United States bonds owned by the Institute, makes a total of $19,929.94 in cash or its equivalent. Subtracting from this amount $4,400, as due to the Life Membership Fund, gives a net balance of $15,529.94 in cash or its equivalent immediately available for any ordinary or extraordinary expenditure of the Institute.

The total amount of bills payable by the Institute April 30, 1905, was $368.82. During the year the property of the Institute was increased by purchase of furniture, etc., to the amount of $667.40, and the stock of *Transactions* to the value of $3,413, all of which was paid from current revenue. As to property of the Institute the report of Chairman Weaver of the library committee showed the conservative valuation of that asset to be about $35,000. It is carried on the balance sheet at $22,705.

Chairman Rice, of the Building Fund Committee, made an encouraging report and promised further activity. The amount already promised for payment in a term of five years is $66,534 and $19,301 has already been deposited to the credit of the fund.

Little work was reported from the Standardization Committee, but an interesting statement was made as to the work and responsibility of the Institute in regard to the National Electrical Code. Lord Kelvin was announced as the recipient of the John Fritz medal, and note was made of organization work done by the Edison Medal Committee. Elaborate reports were made as to the United Engineering Building, and final plans were exhibited in the hall, while President Lieb stated that work was beginning at once on excavation. A very interesting and cheering report as to branches was made by Chairman Scott, of the Local Organization Committee. Messrs. Lieb and Rice filed also an admirable report on the splendid work done last year by the Institute in receiving and entertaining sister societies from abroad. Mr. Waddell made an admirable advocacy for large participation in the Asheville meeting in June.

The proxy tellers, Messrs. Stott and Wakeman, announced the result of the balloting for officers as follows: President, Dr. S. S. Wheeler; vice-presidents, C. A. Terry, T. Wolcott, Gano S. Dunn; managers, C. C. Chesney, Calvert Townley, Bancroft Gherardi, C. L. Edgar; treasurer, G. A. Hamilton; secretary, R. W. Pope.

Dr. Wheeler had the honor of receiving 1,031 votes, his election being almost entirely unanimous, and, it is said, with the largest support ever accorded to any Institute candidate for highest office.

Two papers on the general subject of "Safety Devices" were presented, one by Mr. George F. Chellis, instrument tester of the Interborough Rapid Transit Company, New York, and the other by Mr. H. W. Buck, electrical engineer of the Niagara Falls Power Company, Niagara Falls, N. Y.

Mr. Chellis, in his paper entitled "Time Limit Relays," stated that in existing forms of alternating-current relays of the differential type, the energizing coils consist of two windings with a common magnetic circuit. These windings receive current from a shunt transformer and a series transformer, respectively. In general, relays of this type are so constructed as to include a partly closed magnetic circuit which is closed by the operation of the relay. Differential relays are commonly so connected that the currents in the two coils are in phase when the alternator is operating at 100 per cent power factor. In a three-phase system this is accomplished by bringing out a tap from the center of the secondary coils of the pressure transformers, which are delta-connected, so that the power factor of the relay is approximately that of the alternator. Where the load current is always lagging, the average power factor of the relay may be improved by so connecting the coils as to cause the current in one coil to lead that in the other by 30° at unity power factor, and to lag by 30° at 5 power factor.

No relay having a positive time-limiting device has been placed on the market. In relays brought out recently there has been adopted a form of pneumatic time-limiting device consisting of a bellows, or dash-pot, which is acted upon directly or through a system of levers connected with the core of the solenoid, and provided with suitable means for adjusting the rate of discharge of air. While ideal from the standpoint of simplicity, these devices are not positive, the time adjustment being inversely proportional to the current at which the relay is operated. Since a synchronous converter generates an e.m.f. corresponding to the rated pressure at synchronous speed, it is possible for the machine to feed a short-circuit back through the power house bus-bars, as well as directly over the short-circuited feeders. To fulfill requirements properly, an ideal combination would be an overload time limit relay at the power house end, and an instantaneous reverse-current relay at the sub-station end of each feeder.

With synchronous converters a straight overload time-limit relay in the high-pressure side of the transformers will give satisfactory protection for the alternating-current side, while for the direct-current side a reverse-current relay will be required to protect the machine in the event of the field circuit being opened. Direct-current, reverse-current relays are commonly of the motor type, having an armature supplied from some external constant-potential source, the field coil being energized from the line current. They are provided with a stop to prevent continuous rotation. The relative value of the time adjustment for the various relays depends upon the order in which it is desired to open the switches. Since the current in an affected feeder will always be greater than that in the others, a relay having an inverse time-limiting device may be used to advantage.

The paper by Mr. H. W. Buck had for its subject "Duplication of Electrical Apparatus to Secure Reliability of Service," and discussed merely the general principles involved. The selection of the proper reserve in an electrical installation is nearly always a question involving a balance between a company's obligation to its customers and to its stockholders. From the standpoint of the consumer, the more reserve the surer will be his supply of power. On the other hand, to the stockholders, the less the investment in reserve the larger the dividends. The question is a practical one and no definite laws can be enunciated. The writer expressed the opinion that the maximum overload capacity of the generators should be such that at any time any one of the generators can be instantly disconnected without necessitating a reduction of station load, or causing a serious momentary drop of pressure. There should, if possible, be held as absolute reserve one unit which need not be operated except as a substitute.

The actual installation of duplicate cables in the station wiring and duplicate switches, controlling devices, etc., should be avoided. It is advisable to keep on hand a suitable outfit of jumpers with proper terminals soldered on to use for emergency connections on the switchboard. All important transformer stations should have a complete spare bank which can be shut down at any time without overloading the remaining transformers, and in addition one single-phase transformer should be held in reserve to replace any defective transformer of a bank. In overhead distributing systems there should always be enough circuits installed so that at least one can always shut down without necessitating a reduction in the load. Duplicate or triplicate cables should always be installed where important service is involved in an underground distributing system. In underground conduits, as now generally constructed, the cables are crowded too closely together, and they are in constant danger of destruction in case of a violent short-circuit at the manhole. There is little value in installing spare cables when they are liable to be damaged at just the time when they are most urgently needed.

Mr. H. G. Stott, in opening the discussion on the papers, directed attention to the similarities and differences existing between telegraphic-circuit and power-system relays. Each was brought into use on account of the lack of the ability of the transmitted current to perform the exact duty desired of it. The necessity for the telegraphic relay was due to the reduced value of the received current which was too weak to operate the detecting instruments. The necessity for the power circuit relay, however, was due to the excess value of the transmitted current, whach was too strong to be allowed to operate the interrupting devices directly. Hence, in each case there has been introduced an auxiliary current to operate the devices. In regard to the limiting size of generating stations, the maximum has as yet not been reached, and there seems to be no good reason why stations as large as 100,000 hp cannot be constructed. It is entirely possible so to isolate each generating unit that it becomes a power plant complete in itself with boilers, engine, generator and switchboard separated from all other units. With a hydraulic plant the problem is not quite so simple, because the dam and the water-storage system must in general be common to all units. With reference to the wholesale destruction of underground cables, it is worthy of note that the higher is the operating voltage the less will be the damage in event of the development of a fault. This result is attributed to the decrease of the current with increase of voltage. The e.m.f. should be as high as the insulation of the cables will withstand, and even at the present time 25,000 volts is not excessive

Mr. Philip Torchio remarked that about seven years ago the New York Edison Company installed a few relays, but was much disappointed in the results. Experience showed that some form of inverse time element was needed. A dash-pot was tried, but the results were not encouraging. In the spring of 1903, having learned of the development of the bellows-type relay, forty of these were ordered, and the service rendered has been quite satisfactory. These are used on the high-tension feeders, the various time elements being so adjusted that the relays will operate in such an order as to insure that the service will be interrupted only where the overload actually exists.

Mr. C. W. Richer stated that not only must the electrical apparatus be protected from overload, but protection must likewise be afforded to the steam equipment. In fact, a steam engine is less adapted to withstand a momentary overload than is an electric generator. Under sudden overloads, an engine may so reduce its speed as to cause the reversal of all rotary converters in the system. A trouble encountered in having available duplicate electrical equipment has in the past been due to the large variety of apparatus installed during the period of development of the design of the electrical machinery.

Mr. C. O. Mailloux said that the advent of the satisfactory relay must have been quite recent, and that even at the present time many engineers were inclined to look upon such devices with suspicion. Reverse-current relays are necessary only with rotary converters and similar machines, but are not required with lighting equipments. The fact that the transformers for power systems are almost exclusively single-phase in this country and are polyphase in European countries, may be due to the relatively higher cost for labor here, combined with the excess of hand work needed on polyphase transformers.

Mr. W. F. Wells referred to the use of storage batteries for exciting the generators and supplying the station lights. A storage battery is especially advantageous as a substitute for reserve machinery of all kinds in the power house. Experience has shown that practical immunity from breakdown can be obtained by interconnecting all battery sub-stations by means of reserve cables, and by using fire-proof coverings for all manholes.

Electrical Engineers of the Times.—X.

MAJOR G. O. SQUIER, U. S. A.

Major George Owen Squier, U. S. A., was born March 21, 1865, at Dryden, Mich., and entered the United States Military Academy at West Point in July, 1883. Upon graduation four years later he received a commission as second lieutenant in the Third Artillery. At the outbreak of the Spanish War Lieutenant Squier entered the volunteer service as captain and signal officer, and when honorably discharged in December, 1898, held the volunteer rank of lieutenant-colonel and chief signal officer. In February, 1899, he obtained a transfer from the artillery to the Army Signal Corps, in which he at present holds the rank of Major.

In 1891-2 Lieutenant Squier was a Fellow in Physics at the Johns Hopkins University, where he followed the courses in physics, mathematics and chemistry, receiving the degree of Ph.D. in 1893, the subject of his doctor's thesis being "Electrochemical Effects Due to Magnetism." In 1893 he was a delegate of the War Department to the International Electrical Congress of Chicago, and from 1895 to 1898 was chief instructor in the Department of Electricity and Mines of the United States Artillery School at Fortress Monroe, Va. In 1901 and 1902 he was commander of the United States cableship *Burnside*, and engineer in charge of cable operations in the Philippine Archipelago. At present he is chief signal officer, Department of California.

MAJOR G. O. SQUIER.

Major Squier is the co-inventor with Prof. A. C. Crehore of the polarizing photochronograph and of two systems of rapid telegraphy, both employing the alternating current. The polarizing photochronograph, which is based upon the principle of the electromagnetic polarization of light and was devised for the measurement of the velocity of projectiles, formed the subject of several papers contributed to the *Journal of United States Artillery*, of which periodical Major Squier was one of the founders and a manager for five years. The earlier system of rapid telegraphy, described in a paper read in 1897 before the American Institute of Electrical Engineers, was based upon the employment of the alternating current and on the use of the polarizing photochronograph as the receiver. This system was experimentally operated over the lines of the British post office with satisfactory results. The later system, described in a paper read before the same body in 1900, was one for submarine telegraph service and involved the use of sine wave e.m.f's. This system also gave excellent results in experimental operation over a commercial submarine line. The transmitter used with this latter system was the subject of a paper read before the International Electrical Congress of Paris, 1900. Major Squier and Prof. Crehore also devised an alternating-current range and position finder, and were the joint authors of a paper in the *Philosophical Magazine* of March, 1897, entitled "Discussion of the Currents in the Various Branches of the Wheatstone Bridge, Where Each Branch Contains Resistance and Inductance, and There Is an Harmonic Impressed E.M.F."

Among the more recent work of Major Squier is a study of the absorption of electromagnetic waves by living vegetable organisms, and an investigation of the use of trees in wireless telegraphy as antennæ, which latter has resulted in some remarkable practical developments. He was a strong advocate of an American Pacific cable, on which subject he read a paper in 1899 before the American Institute of Electrical Engineers, and later delivered a lecture before the Naval War College entitled "The Influence of Submarine Cables Upon Military and Naval Supremacy." Among his other work has been a study of the magnetic qualities of gun steel and an electrical method for obtaining a photographic record of the complete motion of a gun during recoil. When the Pacific Coast branch of the American Institute of Electrical Engineers was recently organized, Major Squier was elected chairman in recognition of the interest he has always taken in the Institute and its work. He is a member of the American Mathematical Society, National Geographic Society, Franklin Institute, American Association for the Advancement of Science, American Physical Society and other scientific and professional bodies.

CURRENT NEWS AND NOTES.

DR. M. I. PUPIN has been recommended by the Committee on Science and the Arts of the Franklin Institute for the Elliott Cresson medal for his "Art of Reducing the Attenuation of Electrical Waves and Apparatus." The award is gazetted in the *Journal* of the Institute for May.

INTERNATIONAL ELECTRICAL CONGRESS.—The *Transactions* of the International Electrical Congress, St, Louis, 1904, have issued from the press and will be distributed to members and subscribers during the present month. Those who have not instructed that their sets be sent to a binder will receive the volumes in paper covers, all delivery charges prepaid.

NEW YORK ELECTRICAL SOCIETY.—The 251st meeting of the New York Electrical Society will be held at the American Institute, 19 West Forty-fourth Street, May 24, at 8 p.m. Mr. Charles A. Mudge, formerly chief engineer of the railway department of the A. E. G., Berlin, who took part in the tests on the Berlin-Zossen road, will lecture on "High-Speed, Long-Distance Electric Traction."

THE HARVARD-TECH. ALLIANCE.—According to a dispatch from Boston, the faculty of the Massachusetts Institute of Technology has gone on record, 67 to 6, against the proposed alliance with Harvard. The test vote came recently when the sub-committee of department heads brought in an adverse report. The report was adopted and will shortly be presented to the corporation, which had asked the faculty to consider and report upon the educational aspects of the proposition. The action of the faculty will be communicated to the alumni by the graduate association as part of the information on which the coming letter ballot is to be based.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION MEETING.—The Transcontinental Passenger Association has authorized the following rates from California to Denver and return: Rate—One first-class thirty-day fare. Tickets issued at these rates to be sold via usual diverse routes going and returning. Dates of Sale—June 2 and 3, 1905. Going Transit Limit to Denver—Forty days from date of sale. Stop-overs—Within transit limits. Arbitraries from California—For tickets going direct and returning through Portland, $13.50 additional will be charged from San Francisco, Tracy, Lathrop, Stockton, Sacramento, Redding and their intermediates. From points south of San Francisco, Tracy, Lathrop and Stockton, one way local thereto from selling point to be added to thirteen dollars and fifty cents, not to exceed a total addition of twenty-three dollars from Los Angeles or main line points intermediate thereto. From points south of Los Angeles the one way local thereto to be added to twenty-three dollars, but not to exceed twenty-four dollars from San Bernardino, Colton or Riverside. From Redlands twenty-four dollars and fifty cents to be added.

MUNICIPAL OWNERSHIP.—On May 9 the taxpayers of Sandy Hill, N. Y., voted down a municipal plant scheme by nearly two to one. A week earlier the village of Salem, N. Y., treated a similar proposition in a similar manner.

TELEPHONY IN WISCONSIN.—The subject of taxation of telephone companies and others has been up in a committee of the Wisconsin Legislature. The Wisconsin Telephone Company has favored the ad valorem basis, while some of the independent organizations have equally supported the license fee as more equitable.

TRAIN LIGHTING.—Incidental to the destruction of a Pullman train on the Pennsylvania Railroad near Harrisburg, Pa., by collision, dynamite explosion and fire, the following may be noted: "To add to the horror, a series of smaller explosions then occurred. These were caused by the flames reaching the gas tanks under the coaches. These in exploding shot through the floors and spread the flames from end to end of the cars." It seems pertinent to remark that electric lighting would have avoided this additional horror.

NIAGARA POWER.—The Ontario government has just refused to recommend the ratification of an agreement between the Niagara Falls Park Commission and the Electrical Development Company for the development of an extra 125,000 hp at the Falls. The Electrical Development is the company which, it was reported, the New York Central was anxious to acquire control of for current supply purposes. Well-known men are connected with the enterprise, including Mr. F. Nicholls and Messrs. Mackenzie, Pellatt and others. They will proceed with the original plan for developing 125,000 hp.

ABOARD FOR DENVER.—Mr. George F. Porter, master of transportation of the National Electric Light Association, informs us that arrangements have been completed for a special Eastern train of Pullman sleeping, dining, parlor, smoker and observation cars, via Pennsylvania and Burlington Railways, leaving New York at 10.25 a.m., Saturday, June 3, and running as the second section of the limited, arriving in Chicago at 8.25 a.m., June 4, leaving at 11.15 a.m., and arriving in Denver at 2.30 p.m., June 5. Mr. Porter has issued also a long list of delegates who have already made reservations. It includes nearly 100 names.

NEW SUBWAY FOR MANHATTAN.—The Rapid Transit Commission of New York has decided in favor of a crosstown subway on Thirty-fourth Street, from river to river. It is expected that the board will call for bids for the line within a few months, and that the preliminary formalities will be arranged quickly, so that work can be begun this season. In this case it is expected the crosstown line can be in operation by the fall of 1907 if the contract is given to the moving platform syndicate, or by the spring of 1908, if it is decided to build a regular subway for electric trains. The Board of Aldermen has to pass upon the route.

N. E. L. A. PROGRAMME.—In addition to the programme already presented for the Denver convention, the following items are reported by Secretary Farrand: Report of Committee on District Heating, by W. H. Blood, Jr.; "Free Signs and Flat Rates," by C. W. Lee; "Mercury Arc Rectifier," by P. D. Wagoner; preliminary draft for report of Committee on Rates and Costs, C. L. Edgar, chairman of committee; "A New Type of Single-Phase, Alternating-Current Motor for Elevator Work," by S. Percy Cole; report on advertising methods, by Percy Ingalls; "The Paramount Importance of the Selection of Standard in Preference to Special Machinery," by David Hall.

ST. JOHN RIVER DAM.—Secretary Taft sent last week for Mr. O'Beirne, the British chargé de affaires at Washington, and requested him to ask the British Government that no immediate action be taken by the New Brunswick authorities looking to the removal of obstructions in the St. John River. There is a large dam in the St. John River, and the case involves a question of equitable distribution of the water for power purposes. The Canadian authorities have contended that the scope of the deep water commission included an investigation of the St. John River, while the Washington Government has taken the position that the river was not intended to be so included.

ELECTRIC TRACTION IN ENGLAND.—At the recent International Railway Congress, in the discussion of electric traction, Mr. J. A. F. Aspinall, the well-known manager of the Lancashire & Yorkshire Railway, said that the company did not go into the electrification of their Southport line for the purpose of saving money, but to make money. The results thus far show that the cost per ton-mile is greater and for the train crew less. They were led to make the change on account of the difficulty in handling the crowds at the Liverpool terminal during the rush hours. The cost for electrification of the line was about $100,000 per mile, or about three and one-half times the cost of steam equipment. The weight of the electrical equipment was also greater than of that using steam locomotives. The Lancashire & Yorkshire line has been very successful and is developing new traffic at a high rate of increase. The testimony of M. Sabouret, of the Western Railway of France, was to the effect that electric traction costs more than steam. Electric traction makes possible a volume of passenger business that cannot be handled at terminals by steam locomotives, and it thus becomes profitable, in spite of its apparently increased cost, when measured on the ordinary basis.

ELECTRIC CABS IN BUENOS AYRES.—United States Minister Beaupre, at Buenos Ayres, Argentine Republic, says: "The Compania Alemana Transatlantica de Electricidad (the German Transatlantic Electric Company), with head offices in this city, one of the strongest companies of its kind in the world, controlling the electric lighting and the street railways of Buenos Ayres and suburbs, has decided to utilize its great plant in an endeavor to supplant with electric vehicles the 3,000 cabs of this city. Mr. Mauro Herlitzka, the manager, informs me that his company intends ordering 100 electric cabs by way of experiment, and that he is thoroughly convinced that the demand will be such as to warrant a considerable increase at an early date. The vehicles will be mainly of light landaulet pattern, as best fitted to the climate and in order not to depart too far from the style of light victoria that has proved so successful in the present cab service. During one of my conversations with Mr. Herlitzka I showed him the catalogue of an American firm that makes landaulets; these, he remarked, were too heavy and evidently intended for the cold winters of the north. The style of vehicle he prefers is of similar pattern, but cut lower on the sides, with lighter top, and generally lighter construction. At present his preference seems to be for French coach work and German electrical machinery; but, though buying for a German company, he is unprejudiced, I believe, and determined to secure the vehicle that best suits the conditions of climate, etc., and would be glad to confer with any American manufacturers and to consider tenders from them."

COAL PRODUCTION.—Reports to the United States Geological Survey for 1904, as collected by Mr. Edward W. Parker, statistician, show that the production of coal last year amounted to 351,196,953 short tons, having a total value at the mines of $445,643,528. Compared with 1903 this shows a falling off of 6,158,463 short tons in quantity, and of $58,080,853 in value. This decrease, although proportionately large in the figures of value, does not indicate any interruption to the generally prosperous conditions which have prevailed during the last eight years. It was simply a natural reaction from the abnormal activity which had been maintained throughout the coal mining regions in 1903, due to the exhaustion of all coal stocks on hand by the memorable strike of 1902. In order to renew the coal stocks and at the same time to provide fuel for immediate use, the coal mines in 1903 were pushed to their utmost capacity, or, one should probably say, to the capacity of the railroads to handle the output. As a result the enormous production of 357,356,416 short tons was recorded. Prices raised high by the famine of 1902 remained high for a large part of the year, and the total value of coal at the mines, before any expense of transportation or selling costs had been added, amounted to $503,724,381, an increase of $136,600,000 over that of 1902. The production in 1904, while less than that of 1903 by 6,159,463 short tons, exhibits a normal increase when compared with the annual production during the ten preceding years. The average price for all coal mined and sold in 1904 was $1.27, as compared with $1.41 in 1903, and $1.22 in 1902. Some day it will be interesting to have brought out the effect of water power development, etc., in reducing coal production.

VARIABLE-SPEED SERIES MOTOR.—A patent issued May 9 to Mr. F. J. Newman relates to a method of varying the relative field strength of a series-wound, direct-current motor by using an unsymmetrical field winding. The field coils are arranged in two groups, which may be used singly or in combination. When both groups are in series the motor will run at its lowest rate of speed. If the smaller group is used alone the speed will be at its highest value, while when the larger coil is used alone, the motor will run at an intermediate speed.

HIGH-FREQUENCY ALTERNATING CURRENTS.—As first pointed out by Duddell, it is possible by suitable employment of self-induction, capacity and an electric arc to produce from a continuous current an alternating current having a frequency of, perhaps, 15,000 periods per second. A patent granted May 9 to V. Poulsen describes a method of producing in a similar way alternating currents of, perhaps, a million cycles per second by placing the arc in an atmosphere containing hydrogen. The inventor states that the reason for this advantageous effect can possibly be found in the dissociation of the hydrogen in the electric arc, and that possibly the great diffusibility of the hydrogen is a concurrent cause.

WIRELESS AT RIO DE JANEIRO.—Two De Forest wireless stations have been installed at Rio de Janeiro by the firm of Guinle & Co., of which Mr. Eduardo Guinle, formerly with the General Electric Company at Schenectady, is the senior member. One station is at a fort at the mouth of the harbor and the other on Grand Island, 72 miles distant, a series of mountain ranges intervening. The former station is 300 ft. above the sea and the latter 500 ft., the masts being 130 ft. high. Mr. Harry Athearn, who had charge in China of the London *Times* wireless service which made a notable record with De Forest apparatus, had charge of installing the Rio stations. The stations are stated to be now working successfully.

REACTIVE COIL.—A novel form of reactive coil is shown in a patent issued May 9 to Prof. Elihu Thomson. In form the coil is in the general nature of a helix, except that the radius of curvature of the various turns decreases from the ends of the coil toward the center. This change in curvature is so proportioned that substantially all of the magnetic lines set up by the inner turns thread through all of the turns of the coil, and there is secured a reactive effect much greater than that obtainable with a simple cylindrical coil. The object is to secure a maximum reactance with coils of comparatively few turns, thus insuring a low resistance loss for the normal load current and also a safe operating temperature for the coil.

HOMOPOLAR MOTOR.—A patent granted to Mr. J. E. Noeggerath on May 9 relates to machines of the homopolar type, such as described by him in a paper read before the American Institute of Electrical Engineers on January 27, 1905 (see ELECTRICAL WORLD AND ENGINEER, February 4, 1905, page 250). The patent deals especially with the self-exciting features of the machine, the connections between the armature conductors and the stationary conductors being so arranged that these connections themselves serve to magnetize the machine. When the machine is used as a motor, its speed can conveniently be controlled by shifting the brushes in one direction or the other, since thereby the effective length of each flexible conductor, and consequently the effective turns on the field, will be varied.

THE PART OF ELECTRICITY.—Sir George Armytage, Bart., who has been prominently connected as a steam railroad chairman with the introduction of electric traction in England on steam lines, spoke eloquently about electricity last week in Washington at the dinner given by the American Railway Association to the visiting delegates. His speech showed him also to be a student of the history of the electric traction art, and he made an interesting reference to the work of Davidson on the Edinburgh & Glasgow Railway in 1842. He said also: "There can be no doubt in the minds of those who keep their eyes open that this electrical energy is going to play a great part in all the affairs of men. There are already several miles of railway worked by it, not only here, but in Europe, and day by day we shall see such increases that it would be quite impossible to predict what would be the state of affairs at even so short a period as our next congress in 1910."

MANUFACTURING IN MICHIGAN.—The United States Census Office has just issued a bulletin on manufacturing in Michigan, being the result of co-operation with the State statistical authorities. It covers all establishments on the factory basis, with a production above $500 and becomes part of the national manufacturing census now in progress. As is well known, electricity does not support many factory plants in Michigan. There are reported under the head of "electrical machinery, apparatus and supplies" 14 plants with a total capital of $413,732; product worth $702,102, and 529 wage-earners receiving $176,817. There are also 8 electroplating establishments with $20,278 capital, and product worth $68,700, employing 71 hands who receive $30,965.

CONTROLLING ALTERNATING-CURRENT COMMUTATOR MOTORS.—A patent issued May 9 to Maurice Milch relates to the control of motors of a type which combines the features of the repulsion and the series motors. Each motor is provided with three windings, which for convenience may be designated as the primary circuit on the stator core, the secondary circuit, which is the armature winding, and the tertiary circuit, which is the field winding on the stator core. The current in the field winding is produced by the electromotive force at the armature brushes generated both by speed and by transformer action. The torque is proportional to the product of the magnetism due to the field coil and the ampere-turns of the armature winding, and can be varied by changing either the voltage impressed on the primary winding or by varying the effective turns on the field winding. The present invention relates to the method of varying the torque, first, by connecting the primary coils of a plurality of motors in series and in parallel, thus varying the voltage impressed on the primary windings; and, second, by varying the connections of the different armatures and field coils, thereby varying the effective ampere-turns of the field coils.

ARMATURE WINDING FOR ALTERNATING-CURRENT COMMUTATOR MACHINES.—For the purpose of preventing sparking in commutator type of alternating-current machines, use has been made of a commutator arranged with alternate live and dead segments of equal width, the width of the brush being so chosen that a brush could not span two live segments; thus no coil could be short-circuited during commutation. The disadvantage of this arrangement lies in the fact that the armature circuit would be opened every time a brush was on a dead segment. In a patent issued May 9 to Marius C. A. Latour, the inventor proposes to apply this general scheme to a lap-wound armature in a manner to avoid the open-circuiting effect and yet to retain the non-sparking feature. There are used two commutators placed mechanically on opposite sides of the armature winding, each commutator being composed of alternate live and dead segments, and the live segments being connected to the adjacent side of the armature winding. On each commutator is used a set of brushes, which are so arranged that a brush of one set is on a live segment when the corresponding brush of the other set is on a dead segment. Between the corresponding brushes of the two sets are inserted resistances so proportioned that the short-circuiting currents are kept within any desired limit.

A BUCKET SHOP STORY.—A big bucket shop has just been closed in New York City, of which the judge in the receivership proceedings said that its transactions were all fictitious sales and bogus purchases. Anent this, the *Evening Post* remarks: "A story is told of one of these 'local' shops, which illustrates the character of the people to whom butchers, bakers and candlestickmakers, indiscriminately, hand over their earnings. It was situated uptown, and had been unsuccessful. The proprietors decided to 'sell out.' They found a prospective purchaser in the person of a Greek, who in making an inspection of the 'shop' became impressed with the tremendous business done over the telephone on the desk of one of the partners. This partner was kept constantly answering the telephone to receive orders for 100, 200, 500 and even 1,000 shares of stock. The deeply impressed Greek moved over to the desk and stood like one fascinated. Just then the bell began to ring again. The partner took the receiver off the hook and carried on a one-sided conversation, and after he replaced the receiver, the bell kept on ringing. As fast as the receiver went back on the hook the bell rang again. Then it dawned upon the Greek that he was stepping upon a button placed under the carpet which set the false apparatus in motion, the telephone having really no outside connection at all. On discovering the trick he soon vanished."

Hydraulic Station, La Goule, Switzerland.

BY F. M. BRYAN.

THE hydraulic station of La Goule, in the Bernese Jura region, ranks among the largest in Switzerland. It distributes power to various localities in the surrounding country. Energy is supplied to the station by a fall in the Doubs, a stream which flows for part of its length over the frontier between France and Switzerland. In the neighborhood of Noirmont, at the locality known as La Goule, a landslide from the mountain in the fourteenth century formed a natural dam, and the water which was stopped at this point formed a pool whose difference of level over the lower portion of the river bed is 20 meters.

In order to operate a hydraulic plant at this locality, in 1893 there was formed a company with a capital of $300,000. The firm of F. Rothacher & Co., of St. Imier, was placed in charge of the hydraulic work, and Escher, Wyss & Co., of Zurich, attended to the mechanical part of the plant, including the turbines. The electric equipment was installed by the Oerlikon Company. The distribution of power is of great importance to the different localities of the country in which the watch and clock-making industry occupies the greater part of the population. In the Franches Montagnes, for instance, the inhabitants are especially engaged in the manufacture of watch cases, which requires a certain amount of power supply. Formerly the machinery was driven by man power, and in some places gasoline motors were used. At present the electric motor has caused the abandonment of the old methods.

As to the hydraulic part of the plant, the maximum output of the fall is 20 cubic meters per second at high water and 8 cubic meters at low water. It was decided to build the plant for an output of 18 cubic meters per second, or 4,000 hp as regards the dam and canal, while the hydraulic station was laid out to commence with 2,000 hp. The building is disposed so that it can be increased later on without interrupting the operation of the machines. The water is taken from the river by a covered canal or conduit, with a short open section, and the total length of this portion is 520 meters. The canal has a slope of only 1 per cent., and leads to the penstock, which has 2.25 meters inside diameter.

Current is distributed from the station over single-phase circuits. The alternating-current system was chosen on account of the extent of the lines (15 miles), which needed a high transmission voltage. Seeing that the watch-making industry predominated in the region, a large number of small motors could be counted upon. In order to avoid the disturbances which the motors would produce upon the lighting circuit, it was decided to run two separate lines, one for lighting and a second for the motors. The single-phase system is used in each case. The increased expense needed for the lines and for the transformer stations is largely compensated by the advantages which are obtained by separating the two circuits.

The station is laid out so as to accommodate four distinct turbine chambers, each one to contain a turbine with vertical shaft for coupling direct with the alternator. This arrangement allows of a complete separation of the hydraulic and the electric parts. Above the turbine chambers is the dynamo room, a view of which is shown in Fig. 1. It contains four alternators, the exciters and the switchboard. The length of the room is 21.2 meters, by 8 meters wide. A repair shop and different offices complete the building.

A penstock 2,250 meters long leads to the turbines, and for each of the latter there is a branch conduit which can be closed by a gate. The turbines were installed at two different periods. At the beginning there were three turbines of 500 hp each. Escher, Wyss & Co., of Zurich, supplied these turbines; they are known as the Francis pattern. The cast-iron shafts are hollow, and rest upon a Fontaine pivot support. A hydraulic apparatus is used to take most of the load off the bearing. A special type of automatic speed regulator is used here. The tests showed that for a head of water of 24.9 meters the power at the turbine shaft is 500 hp on an average. The efficiency is 80 per cent. at full load. The shaft of the fourth turbine, which was installed later, is also vertical. It delivers 650 hp and runs at 375 r.p.m. The shaft is of steel and runs in a ball-bearing pivot, using a hydraulic device to relieve the pressure. This turbine is of the new Francis type. The vanes of the wheel are movable, and are connected with a ring which allows them to be opened or closed within certain limits. Under test this turbine gave 730 hp at the above speed, with an efficiency of 81 per cent. at full load and 75 per cent. at half load. It is provided with an automatic regulator composed of a piston working in a cylinder, acting as a hydraulic motor. A centrifugal device on the wheel acts so as to control the water pressure upon the hydraulic motor, and push the piston either up or down. The piston in turn acts upon the turbine to increase or diminish the speed by working the movable vanes.

The first part of the generating equipment comprised three Oerlikon alternators of 500 hp each. Later on there was put in a fourth alternator of 650 hp, of about the same type as the preceding. Each machine has a revolving field and a fixed exterior armature. Their appearance will be noted from Fig. 1. The fixed armature is separated from the cast-iron ring support. The first three alternators, which run at 200 r.p.m., take 500 hp and furnish a current of 63

FIG. 1.—INTERIOR OF POWER HOUSE, LA GOULE, SWITZERLAND.

amp. at 5,500 volts, corresponding to an efficiency of 94 per cent. The frequency is 50 cycles. The armature winding consists of 30 double coils, each having 29 turns of 4.7 mm. copper wire. The fixed structure carries 30 coils around the periphery. Each coil is made up of 500 turns of a 6.2 mm. wire. The weight of the revolving portion is 10.8 tons and its diameter is 2.488 meters. The outer part, with its two arms, weighs 13.8 tons.

The fourth alternator is illustrated in Figs. 2 and 3. It takes 650 hp at 375 revolutions and delivers a current of 100 amp. at 5,500 volts, corresponding to an efficiency of 94.8 per cent. The frequency is the same as above. The armature has 64 slots and 32 coils. Each of the latter is made up of 11 conductors of 3 wires each, having a diameter of 4.1 mm. The field core is wound with 16 coils connected in series, each coil being composed of 18 turns of copper band 180 by 1.5 mm. The layers are separated from each other by a 0.5 mm. asbestos sheet. The revolving part of this machine weighs 10.3 tons and measures 1.8 meters in diameter. The total weight of the alternator is 33 tons. Besides the usual insulation of the turns and layers, the entire armature ring is insulated from the support. The exciting power for the 500-hp alternators is 0.75 per cent. of the total power, and for the latter machine it is 0.78 per cent. The exciters are driven from the shaft of the corresponding alternators, and are two-pole, shunt-wound machines. At a speed of 700 r.p.m. they give a current of 30 amp. at 80 volts. The plant has also a small 4-hp dynamo in the repair shop.

The current is brought to the switchboard from the alternators and exciters by conduits placed under the floor of the dynamo room. There are two main switchboards placed opposite each other

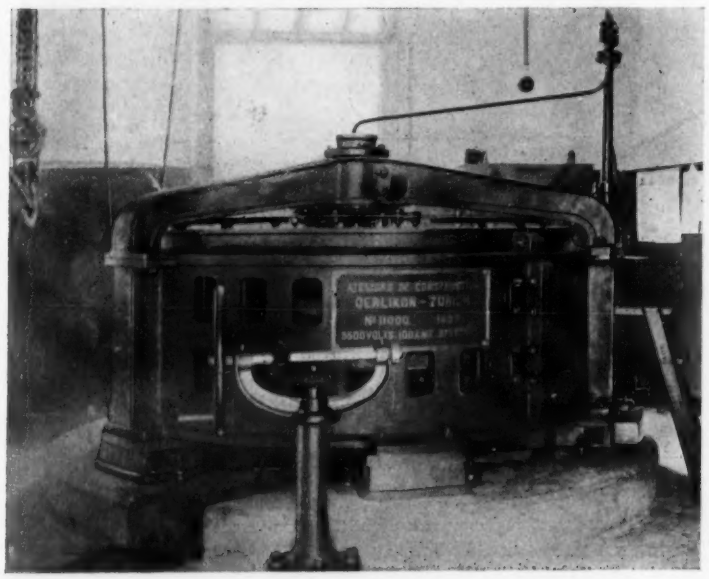


FIG. 2.—REVOLVING-FIELD ALTERNATOR.

on the main walls of the room. One switchboard is used for the French circuits and the second for the Swiss circuits. The latter, which is the principal board, is composed of three black marble panels carrying the measuring instruments and the switches. The ammeters and voltmeters are insulated by sheet mica for greater security. The lighting and power circuits are quite distinct from each other. The first of these circuits starts from the left-hand panel and the second from the right-hand panel, while the center panel carries the main switches for the machines, the voltmeters and the ammeters for the alternating current, the exciter instruments, the phase indicators for coupling the alternators in parallel and the changing switches for throwing the alternators upon the lighting or the power circuit. Each of the side panels, one for the lighting and the second for the power, has a voltmeter with a transformer compensator which shows the voltage at the farthest end of the circuit. Each panel has also an optical signal combined with a relay, which operates when the voltage passes the limits. The second switchboard for the French circuits has two panels of the same kind for the lighting and power lines.

The construction of the overhead line in the La Goule system proved one of the most important features of the plant. The character of the country which it traverses, as well as the severe winters which prevail there, make it necessary to have a line possessing special qualities. The country is mountainous, so that in many places the line must pass over places far from any roads. In the Franches Montagnes there is often six feet of snow in the winter, which makes all communication difficult and renders it almost impossible

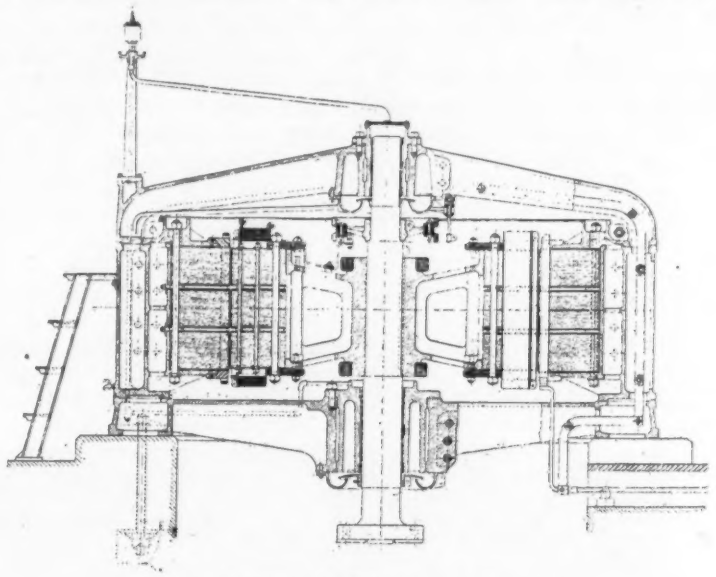


FIG. 3.—SECTION OF 650-HP ALTERNATOR.

to inspect the lines. Moreover, heavy snowstorms are frequent upon the plateau. These conditions make it necessary to construct the line with the greatest care, so as to avoid any interruptions of the service. Fig. 4 represents the line as it leaves the station. It is fixed upon double poles, consisting of two wood poles, some 40 ft. long, inclined together and bolted at the top. Nearly two-thirds of the poles are planted in the solid rock. Great care had to be taken in connecting the wires at the ends, and all wires above 6 mm. are

FIG. 4.—POWER HOUSE AND TRANSMISSION LINE.

connected by sleeves, somewhat as in the case of tramway lines, and these are well soldered. Simple porcelain insulators are used. The circuits starting from the La Goule station comprise three lines each for lighting and power on the Swiss side, and two of each on the French side. The length of the primary circuit in the former case is 44.7 km. (27.7 miles), and practically the same distance on the French side.

At different localities along the primary circuits are placed the

transformers for the lighting or motor circuits. They are contained, either alone or in groups, in small houses built of stone. In general a single transformer house is placed in the center of a given locality, so as to diminish the number of high-tension lines. Fifteen localities on the Swiss side and twelve on the French side are thus provided. Each transformer station contains a switchboard panel for the light and motor circuits. The latter are laid out on the three-wire system.

Monophase motors, built by the Oerlikon Company, are in use in the present system. Heretofore this type of motor had the disadvantage of starting up with some difficulty, even at light loads. The present motors overcome this difficulty by a simple arrangement. The distance between the motor and the bearing on one side is increased and the shaft carries a fixed and a loose pulley placed side by side. When the motor is at rest the belt is on the loose pulley, so that the motor has no load at starting. When it reaches the right speed, a mechanism worked by a hand wheel brings the loose pulley against the fixed one, and the two are locked together by a suitable clutch at the side. The loose pulley is drawn along with the other, and when it reaches the required speed, the belt is shifted on to the fixed pulley, and the loose pulley is drawn back to its former position.

For starting the motors a special arrangement is adopted by the Oerlikon Company. The motors, as will be remembered, are run on a three-wire secondary system. During the starting period the motor is connected between an outer and the middle wire, and is, therefore, subjected to one-half of the full running voltage. A phase-splitter, using an induction coil, is employed for giving to the motor a starting torque. When the motor has reached the normal speed, a double-throw switch is placed in the running position, thereby cutting out the starting circuits and placing the motor directly across the outer wires.

The Central Station Superintendent.

By G. Wilbur Hubley.

THE position of superintendent in the modern central station is one deserving most careful and scrutinous attention on the part of the owners of such properties. Large values are placed under the custody and care of the individual filling this position, and results of operation and maintenance of the installation are dependent on the competency of the man selected for the office, and, in consequence, the earning power of the plant is almost, if not entirely, dependent on the proper and able action of the superintendent. It should be appreciated, therefore, that the superintendent is the very heart of the commercially successful plant, and the selection of such a man is of most vital interest and weight to the owners.

The man filling such a position should possess the characteristics of honesty, concentration, perseverance and conscientiousness of purpose. Essentially, a good education is requisite, and it is of special value for such to be of a technical nature, rather than of a practical one, although a proper combination of both is to be desired. However, the most important item in the education of a superintendent is that of logical reasoning power, in order that all theories and conclusions shall be well balanced and their application to actual practice be made with regard to their commercial adaptability, as well as to their accuracy and precision as viewed from an engineering point of view.

An engineering education is certainly most desirable, if not absolutely essential to the qualifications of a superintendent of the central station, in order that he may be prepared to successfully meet all problems which will be presented from time to time.

The proper solution of important questions often call for peculiar integrity of judgment. It is necessary that the decision be the result of a complete and thorough knowledge of all the circumstances and conditions of the detail factors of each individual problem presented, and that such conclusions be given only after most careful and earnest investigation and research.

Only after years of experience, during which time the mind has developed to the point of meeting all exigencies that might arise in central station management, is the superintendent equal to all emergencies and fitted for the larger and increased responsibilities which may devolve upon him by undertakings of more stupendous character.

Experience is said to be a severe teacher, and no doubt this is true where it is the result of ignorance or lack of proper judgment, but the experience, which emanates from the march of civilization and the improved devices and methods developed from year to year, is a factor of education of more value than all others to the man who is capable of grasping the knowledge so offered. The salvage of the knowledge to be had from the past experience and methods used in former work of others, as well as that of one's self, is invaluable as assistance in the consideration of new projects or in the adoption of best methods and system to be employed in the direction of work under charge.

The superintendent should be a good statistician, even to the extent of this characteristic being a "pet hobby." The value of keeping records and data of all details of work and station routine, especially as relating to costs, cannot be over estimated. It is necessary that a complete and thorough system for arranging such data be devised, in order that the various details of subjects can be properly classified and indexed and at all times be conveniently and readily available for reference. Like wine of early vintage, their value increases with age, for it requires some time before any correct deductions can be taken from compiled data. With complete detail data, it is possible to adopt certain standards in particular lines of work, and the incentive to improve and raise these standards is one that inspires ambition in the superintendent and his assistants.

The superintendent who is a close student of human nature and is capable of discerning the qualifications and characteristics of other men will find this talent of greatest value in his judgment of selection of employes and the assignation of the man of proper calibre to the class of work to which he is best fitted, and when opportunity for advancement or promotion of old employes is presented, the task of selection of men best adapted for the new opening will be facilitated.

While prompt and decisive action of superintendent is desired, yet it is necessary in order to achieve highest success to have qualities of deliberation and conservatism, and in case of undertakings where great responsibilities are involved he must, in justice to himself, as well as others, approach the same with caution and carefully weigh and consider all conditions that may tend toward success or failure of the project. However, when conclusions have been so derived, he must have the courage of his convictions and act accordingly, without deviation.

Under present strenuous demands and conditions surrounding the modern central station, it behooves the superintendent to be progressive and up to date in his ideas and methods. In fact, there is no zenith where the successful superintendent may rest and feel satisfied with his past records, even though such records be only of complete success.

The superintendent will find it most valuable to associate himself in the membership of the leading engineering societies in the country, and, as far as it is practicable to do so, to give his support and take active interest in their affairs by contribution of original papers, or taking part in discussions. The records of such societies act as a reservoir for the storage of knowledge, and the privileges of membership are most valuable to the successful man of this profession. Not less in importance is the necessity of reading the leading engineering and technical publications, and in this regard it is necessary to use careful discernment in selecting the periodicals which are to be adopted for regular and systematic reading. Most valuable suggestions are to be obtained from the articles descriptive of new installations, and by such information one can keep informed of the progress and development of other plants. It is, of course, necessary that the superintendent follow the review of standard books on special subjects relating to his work, and, in general, to keep pace with the times by reading of all new work, or proposed plans of systems for the central station.

The personal equation of the central station superintendents gives evidence that it is an all-important factor. Frequently it may be observed by investigation that one electrical system will prove to be commercially successful, while another system with similar equipment and conditions will be shown to be a failure. Results at such variance can often be proven to be due almost directly to the superintendence factor. The attainment which is often held up as the pinnacle of success to which the superintendent should strive is the condition of "keeping running." It is true that primarily this condition is essential to all other results, but it should

be considered as being only the base line from which all attainments of success should start, and the principal consideration naturally is reduced to the question of economy of station maintenance and operation. To secure best results in station economies the superintendent must become familiar with the minutest details by regular and close attention to the operation and methods employed in the various departments.

The superintendent in charge of plants must be a good disciplinarian, as it is essential to the good of service that system and regulation among the employes should prevail. His orders and directions to employes must be brief, concise and definite and admit of no misinterpretation or misunderstanding.

In general, the superintendent of the central station must possess such peculiar knowledge and experience accompanied with executive ability as to be able to have complete and systematic control of the operation of the property under his charge, and he should strive to maintain the highest standard in all departments.

The Law of the Plunger Electromagnet.

BY CHARLES R. UNDERHILL.

IN a recent article* entitled "The Predetermination of Plunger Electromagnets," Prof. Sylvanus P. Thompson based his calculations upon the formula

$$P = \frac{B^2 A}{72{,}134{,}000}, \qquad (1)$$

where P is the pull in pounds, and also on the formula

$$I N = .3133\, B\, l \qquad (2)$$

where B is the flux density in the working air-gap, l representing the length of the gap and $I N$ the ampere-turns in the winding.

Prof. Thompson further stated that "It is found in practice that the maximum pulls are given with great accuracy by the above rules,

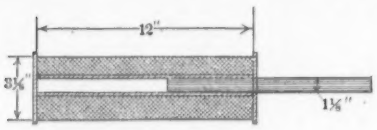


Fig. 1.

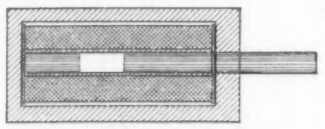


Fig. 3.

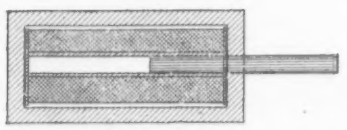


Fig. 2.

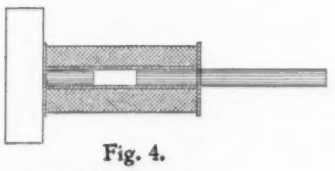


Fig. 4.

FIGS. 1, 2, 3 AND 4.—SHAPES OF ELECTROMAGNETS.

but that, owing to secondary causes, the minimum pulls are rather higher (in some cases several per cent.) than the calculated values.

Now from (2) $$B = \frac{I N}{.3133\, l}. \qquad (3)$$

For the purpose of this article we will make use of a general expression by substituting the value of B from (3) in (1), whence

$$P = \frac{\left(\frac{I N}{.3133\, l}\right)^2 A}{72{,}134{,}000} = A \left(\frac{I N}{2660\, l}\right)^2 \qquad (4)$$

As the writer has occasion to design plunger electromagnets for many purposes, and under varying conditions, a series of tests were made by him to determine the exact behavior of this type of electromagnet, the results of which show that the equation

$$P = A \left(\frac{I N}{2660\, l}\right)^2$$

is not strictly correct, or rather it is not complete.

Instead of starting out with a complete plunger electromagnet, let us follow its evolution and note first the effect due to a simple solenoid and plunger. We will take an actual case to illustrate this.

Fig. 1 shows a simple coil and plunger and Fig. 2 the same magnet, but with an iron jacket or return circuit about the outside of the winding. This is usually referred to as an iron-clad solenoid.

By placing a "stop" inside the winding at the rear end of the frame, we have the plunger electromagnet in Fig. 3.

It is to be observed that the same coil and the same plunger are

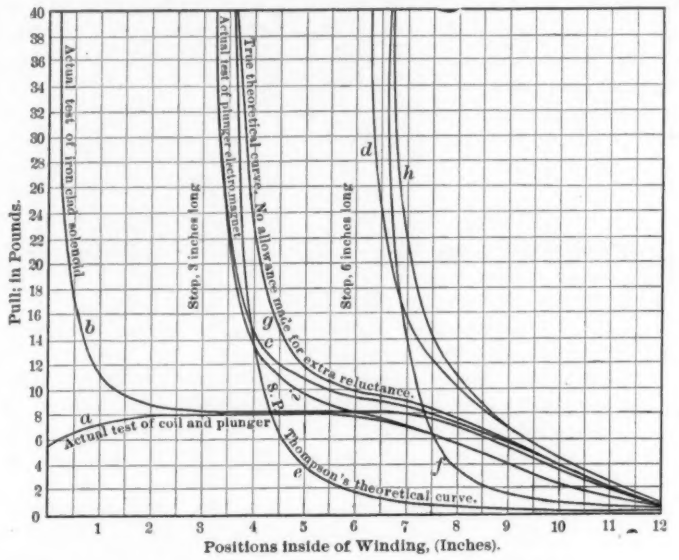


FIG. 5.—CHARACTERISTICS OF ELECTROMAGNETS.

used in each case. The cross-section, A, of the plunger is just 1 square inch.

Referring to Fig. 5, curve *"a"* is due to the simple coil and plunger in Fig. 1, and curve *"b"* is due to the iron-clad solenoid in Fig. 2, the ampere-turns in the winding being 10,000 in all cases. It will be noticed that the only difference between curves *"a"* and *"b"* is that curve *"b"* is slightly higher at distances greater than 6 in., owing to the confinement of the field, and also that it bends upward for short distances instead of falling off like curve *"a."* This latter effect is due to the attraction between the end of the plunger and the iron frame of the iron-clad solenoid. However, the pull throughout the center of the winding is the same in both cases.

Curves *"c"* and *"d"* are due to the plunger electromagnet in Fig. 3. These curves never fall below the curve *"b"* for the iron-clad solenoid, and this explains why the minimum pulls are several per cent. higher than the pulls calculated by formulæ (1) and (2).

Curves *"e"* and *"f"* are calculated from (1) and (2). It will be noticed that these do not coincide with the curves *"c"* and *"d,"* which are from actual tests. The reason for this is obvious. The plunger electromagnet is but an iron-clad solenoid with a "stop," and hence must follow the law of the iron-clad solenoid; but there will also be an attraction between the end of the plunger and the stop, and this extra attraction does follow the rule

$$P = A \left(\frac{I N}{2660\, l}\right)^2$$

but the total pull is the pull due to the attraction between the field of the winding and the plunger, plus the pull due to the attraction between the plunger and the stop.

Where there is a high density of the lines of force in the plunger, an additional reluctance is in evidence, which must be added to the length of the working air-gap.

Curves *"g"* and *"h"* are calculated by formula (4) and the pulls obtained added to the pull due to the iron-clad solenoid at those points. These curves are calculated on the basis that there is no reluctance other than in the working air-gap. Inspection of these curves, however, shows that .4 in. must be added to the length of the working air-gap for this particular case, and since $I N = 10{,}000$ and $A = 1$, formula (4) becomes

$$P = \left(\frac{10{,}000}{2660\ (l + .4)}\right)^2$$

Recalculating on this basis, we obtain curves *"c"* and *"d,"* which proves this reasoning to be correct.

*ELECTRICAL WORLD AND ENGINEER, Dec. 10, 1904.

Now, the pull at the center of an iron-clad solenoid (neglecting the increased pull between the plunger and the frame at the end of the winding) is the same as the pull due to a simple coil and plunger.† Hence, the pull due to an iron-clad solenoid is

$$P = \frac{A P_c (IN - n)}{10{,}000 - n}, \qquad (5)$$

where 10,000 ampere-turns are allowed for each square inch of plunger; that is, IN equals, or is greater than, $10{,}000 A$.

Here Pc = pull at 10,000 ampere-turns and 1 sq. in. of plunger, n = ampere-turn factor. (See table.)

In the table L = the length of the winding.

L	Pc	n
1	33.0	3600
2	28.3	3150
3	23.4	2800
4	19.2	2500
5	16.0	2200
6	13.8	1970
7	12.2	1750
8	11.0	1580
9	10.0	1400
10	9.2	1230
11	8.4	1100
12	7.8	1060
13	7.2	840
14	6.8	725
15	6.4	625
16	6.0	525
17	5.7	430
18	5.3	350
19	5.0	270
20	4.7	210

Therefore, at points along the uniform range of solenoids the pull for the plunger electromagnet would be

$$P = A\left(\frac{IN}{2660\ l}\right)^2 + \frac{A P_c (IN - n)}{10{,}000 - n}, \qquad (6)$$

or

$$P = A\left(\frac{IN^2}{7{,}075{,}600\ l^2} + \frac{P_c (IN - n)}{10{,}000 - n}\right). \qquad (7)$$

Here l must include the extra length assumed due to the reluctance outside of the working air-gap.

By referring to Fig. 5, it will be noticed that the curve *"b,"* which is from the iron-clad solenoid, falls off in nearly a direct ratio from 8 pounds to approximately zero, beginning at 7 in., and ending at 12 in., or the frame limit. This effect was found to be common to several different sizes of coils and frames, which were tested. Therefore, to approximate the curve of a plunger electromagnet at points between the center of the winding, and the end of the winding where the plunger enters, assume that the curve is a straight line for the last .4 of the distance; then the pull at any point, *la* as measured in inches, back from the end of the winding, will be

$$P = A\left(\frac{IN^2}{7{,}075{,}600\ l^2} + \frac{la\ P_c (IN - n)}{.4L\ (10{,}000 - n)}\right) \qquad (8)$$

where L = length of the winding. In this it is assumed that the winding is approximately as long as the inside of the frame.

In cases where a low density in the core is used, the curve for the iron-clad solenoid effect cannot be calculated with so high a degree of accuracy.

To demonstrate how little the outer frame has to do with the action of a plunger electromagnet, a test was made with the magnet in Fig. 4, which has no iron return circuit, but has a stop 3 in. long mounted on a block of iron. This curve is marked *"i"* in Fig. 5, and should be compared with curve *"c."* It will be noticed that the lower part of this curve *"i"* tends to follow the lower part of the curve *"a,"* which would appear to be perfectly natural, as there was no iron at the mouth of the winding, other than the plunger itself, when the curves *"a"* and *"i"* were made.

This would indicate that it is not necessary to use a very heavy iron frame, and that the magnetic connection between the plunger and the frame at the mouth of the winding is not a matter of much importance for electromagnets of the types discussed.

†"Calculation of Pull Due to Solenoids," C. R. Underhill, ELECTRICAL WORLD AND ENGINEER, May 13, 1905.

Meter Testing For Small Stations.

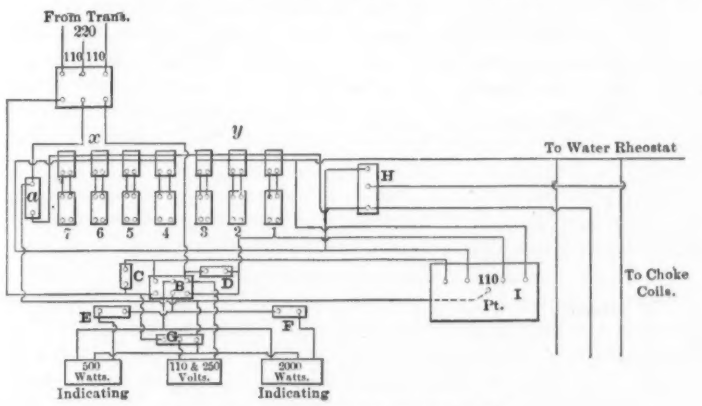
BY A. E. WALDEN.

THERE is a great disposition on the part of small stations operating at the present time to disregard the testing of consumers' meters, and here lies the root of considerable trouble originating in complaints as to the size of bills. The first cost of a simple rack for testing meters need not be very great compared with the results obtained. It is unnecessary to purchase for this purpose high-priced portable instruments, since switchboard instruments of the horizontal edgewise type, which cost very much less, are equally as permanent in calibration and sufficiently accurate for the results desired.

In the testing laboratory there should be provided transformers so connected that two-phase currents may be obtained for testing polyphase meters and for ascertaining if the proper phase angle exists between the magnetisms due to the shunt and series coils of single-phase meters.

Of the many faults in the operation of alternating-current meters, the most serious is that due to lack of adjustment for changes in power factor. It is not uncommon to find a meter which, although correct for any load at 100 per cent. power factor, may be in error from 5 to 25 per cent., either fast or slow, when used on inductive loads. It is evident that an error of this nature should be studiously eliminated when the meter is intended to be used with motors or arc lamps.

A convenient method for obtaining loads having power factors as



METER TESTING FOR SMALL STATIONS.

low as 50 per cent. is found in the employment of choke coils such as are used in alternating-current arc lamps designed for constant-potential mains. A bank of five or six of these coils, arranged for series or parallel grouping, will prove sufficient for the small station having from 400 to 1,200 meters.

For general testing purposes it is economical to use a single standard 5-amp. meter in combination with current transformers when larger capacities are required.

For the testing department of a small central station, the following instruments will be required: An indicating wattmeter, 0 to 500 watts, 110 volts; an indicating watmeter, 0 to 2,000 watts, 110 volts; a voltmeter, 0 to 250 volts, with special point at 110 volts; a portable ammeter, 0 to 25 amp., and a stop watch, which should be checked frequently with government standards.

Means should be provided for changing the voltmeter from the 250-volt to the 110-volt connection when desired. A single-pole, double-throw switch which accomplishes this purpose is indicated at G in the accompanying illustration. Referring to this sketch, a is a switch for opening the neutral wire, B is a double-pole, double-throw switch for changing from one wattmeter to another, C and D are switches for short-circuiting the current coils of the wattmeters, E and F are switches for opening the circuits to the current coils of the wattmeters, H is a single-pole, double-throw switch for changing the load from the 110 to the 220-volt circuit, I is a block for connecting the meters to be tested, and switches 1 to 7 control various groups of lamps.

Although the indicating wattmeters, as listed above, are designed for only 110 volts, it is possible to use them for checking 220-volt wattmeters, if the potential coil of the indicating instrument be connected across between the neutral and one outer lead. In this case, if the two voltages to the neutral wire are equal, and the switch in

the neutral wire is opened so that no current flows therein, a multiplying constant of 2 may be used. If, however, the two voltages are not equal, correction must be made in the multiplying constant according to the inequality.

It may be of interest in this connection to state that frequently induction watt-hour meters may be caused to record more accurately on light loads by so adjusting the driving torque that under normal conditions the disc will creep slightly on no-load, and then slotting the disc to prevent creeping. The moving element will revolve under no-load conditions until the slot reaches a position either between the series coils or under the potential coil, and will there come to rest.

Some Points in Selecting Fan Motors.

BY HOWARD S. KNOWLTON.

The rapid approach of the warm season is a signal for the development of the fan motor business by central stations and supply houses, and if one can judge by the past it is safe to predict a more extensive appreciation of these machines on the part of the public this summer than ever before. Confronted by numerous attractive styles and designs of fan motors the purchaser often finds himself at a loss to decide which one to buy. Except in connection with the selection of equipment for a considerable plant the problem is not one requiring the expense of expert advice other than that available from the experience of central station men and the representatives of the manufacturers themselves. The purchase of a hundred fan motors at $12 each is so small an outlay in comparison with the cost of generators, switchboards and other heavy equipment, that it is not worth while to go to extremes of refinement in setting one make against another. At the same time, the characteristics of a good fan motor are worth knowing, so that an intelligent decision can be reached.

The perfection which has been attained in fan motor design is readily seen when one considers the service requirements which are constantly being met. It is nothing unusual for such a machine to be in practically continuous operation for five or six months without the slightest attention being paid to it. With the exception of the recording wattmeter it would be difficult to cite a piece of revolving electrical machinery from which such constant service without inspection or adjustment is required. A thorough overhauling at the beginning of the season is the natural right of every fan motor, and an occasional but regular inspection of its performance during its working period is desirable. The ability to operate continuously without breakdown, and without distracting noise or excessive power consumption is one of the fundamental requisites. Granted these and a pleasing design to the eye, price becomes a matter of secondary importance.

Complicated designs are out of place in machines performing the simple task of propelling air about a room, and the purchaser should look with suspicion upon intricate moving parts. Simplicity and reliability of operation almost always go together in the last analysis. It should be easy to take a fan motor apart and examine its interior, and liberality in the use of material is a good feature. Sufficient copper ought to be allowed in the commutator construction to permit turning down the metal once or twice. In the matter of speed, ceiling fans do not, as a rule, require the variation which ought to accompany desk fans, but in the writer's judgment, at least two speeds are desirable for the former and three for the latter. Large wearing surface in the bearings is a point to look for, and self-aligning and self-oiling journals are conceded by almost every one to be features of great importance. In fact, practically all fan motors of the better type require little if any attention in the way of lubrication, once the season's run has been started. The cost of attendance must be held down as near the zero limit as the annual overhauling permits. It is a pretty good thing to find out what other people's experience with fan repairs and breakdowns has been with a given type before purchasing.

Preference should be given to designs which absolutely prohibit the scattering of oil, as such a calamity may easily destroy legal or other papers upon an office desk of many times the value of a dozen fans. Noise has already been mentioned, and any one who takes the trouble to examine a great variety of fan motors in operation soon learns that silent operation is yet to be attained in more than one make. The presence of a fan motor should be *felt* rather than *heard*, for the distractions of life are numerous enough already without adding anything needless to the existing assortment. The blades should be firmly secured to their supporting hub, as very dangerous possible injuries accompany the working loose of either wooden or metal blades when revolving from 300 to 2,000 r.p.m. In this connection a heavy guard is important in cases where a fan is likely to be accidentally touched by the hand, for one could hardly suggest an easier method of losing a finger or two than to bring one's digits in close touch with a modern electric fan. Of course, as the guard becomes more elaborate the fan motor must either be run at a somewhat higher speed or propel a larger set of blades to be equally effective in circulating the air, so that most makers have compromised on a rather limited guard. There would seem to be a field, particularly in domestic use where children are prone to be inquisitive, for the marketing of a fan with a screen somewhat finer than the present coarse arrangement.

Dust-proof qualities are essential in the frame of a fan motor, but, above all, the bearings should be tight. Standing without attendance for many weeks at a time the fan motor needs to be protected from any possible overheating of bearings and consequent shutdown through the admission of dust particles. When the motor has a commutator, this also should be well protected from exterior dirt. It is a great advantage to have oil reservoirs which will not spill in any position. The commutator ought to be as well insulated as the same part of a larger motor for the same voltage, micanite insulation between the bars and shell being far better than fibrous material. The use of solder in the motor should be as limited as possible in view of the bad results of overheating. If the speed-controlling device is mounted upon a porcelain base the chances of short circuit are greatly reduced. Some of the better makers of fan motor employ german silver wire embedded in enamel for the resistance element. Carbon brushes have long been accepted as standard by the manufacturers of reliable machines. They should be held in place in such a way that they cannot be broken by jarring.

Laminated pole pieces and wide polar angles also tend toward compactness and efficiency. Light weight is very desirable where a motor is to be moved about freely, but in stationary types it is less important. Some idea of the smoothness, of running can be readily obtained by timing the slowing down of the motor from full speed to zero with the current suddenly cut off. When a large number of motors are to be purchased a few simple comparative tests are well worth making. Thus the temperature rise after a run at full or partial load can easily be taken with a thermometer, the speed measured with a tachometer, the input of power obtained from the simplest instrument readings with indicating wattmeters, voltmeters or ammeters, etc. It is also a simple matter to compare the relative performance of different motors by setting them up to blow air through a cardboard or wooden chute with an anemometer in the air stream, or if the latter instrument is not available, to improvise a swinging door provided with a suitable pointer or weight pan to evaluate the work done.

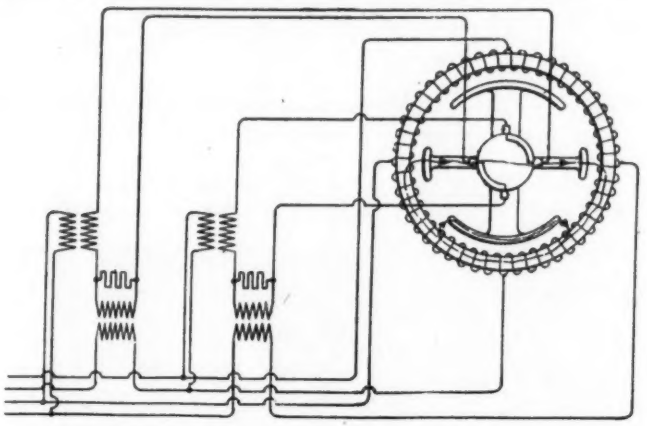
Although it is safe to say that no fan motor contains a monopoly of good points, the writer believes that a little discrimination along the lines suggested will result in more intelligent selection of such equipment.

Self-Exciting, Alternating-Current Generator.

Two patents issued May 9 to Mr. E. F. W. Alexanderson relate to alternating-current generators of the type in which the current for field excitation is obtained from the armature and rectified by means of a commutator.

On a two-part commutator, whose segments are connected permanently to the terminals of the field coils, are placed pairs of brushes equal in number to the number of phases of the machine. These brushes are subjected to e.m.f's derived from the secondaries of potential transformers. To render the exciting circuit practically non-inductive and to compensate for varying power factors and values of the loads on the machine, there are placed in series with the potential transformers non-inductive resistances across which are connected the secondaries of series transformers. The series transformer serves to impress upon the terminals of the resistance connected in the exciting circuit a potential varying in magnitude and phase with the current in the main circuit.

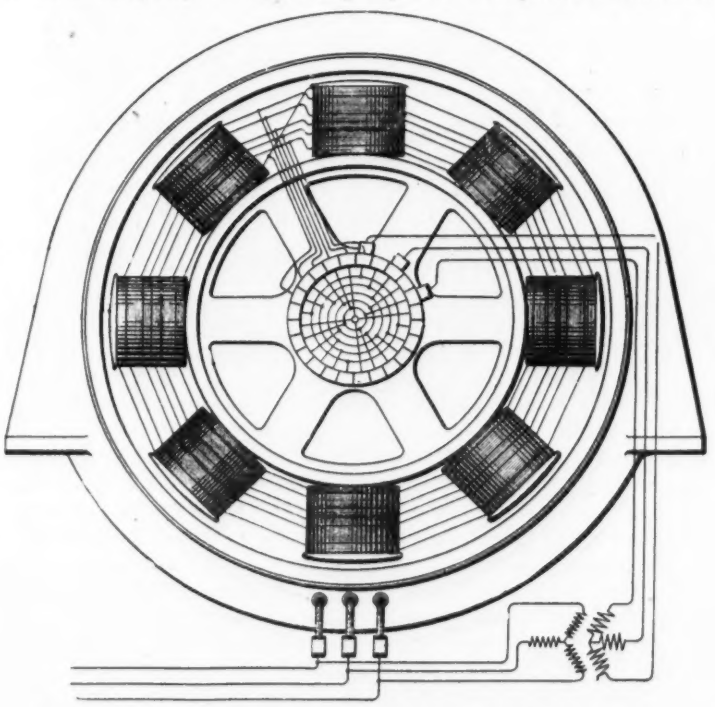
A disadvantage found when this scheme is used in its simplicity resides in the fact that the proper neutral e.m.f. points on the commutator, at which the brushes should be placed for sparkless operation, varies with the time phase of the exciting voltage which changes with both the value and power factor of the load. The inventor has observed that the reaction of the armature current on the field magnetism tends to balance this variation, since it shifts the time phase of the generated e.m.f., and consequently of the exciting e.m.f. derived from the potential transformers, relatively to the mechanical position of the poles and of the commutator segments. In order to make the counterbalancing more effective, the inventor provides small auxiliary poles placed between the usual field poles so as to offer a low-reluctance path for the armature flux at points between the poles produced by the field winding, as indicated in the accompanying illustration.



ALEXANDERSON SELF-EXCITING, ALTERNATING-CURRENT GENERATOR.

Alternating-Current Generator with Polyphase Excitation.

An interesting form of self-exciting generator is described in a patent issued May 9 to Marius C. A. Latour. The winding of each individual field coil is in six sections. The corresponding sections of all of the field coils are connected in series with each other, so as to form six groups. These six groups are then placed in series in a closed circuit; that is, with the end of group No. 6 connected to the beginning of group No. 1. The six junction points between the groups are connected to a rectifying commutator containing six segments per pair of poles, interconnected in sets corresponding to the number of pairs of poles, as shown in the accompanying illustration. Polyphase e.m.f. is impressed upon the commutator by means of suitable transformers.



LATOUR ALTERNATING-CURRENT GENERATOR WITH POLYPHASE EXCITATION.

The number of turns in each group of coils is so selected that the resultant magnetomotive force of the currents in all of the groups due to the alternating e.m.f's impressed upon the several groups will remain at all times unidirectional and of a practically constant value. The inventor states that the successive groups should contain the number of turns represented by the following expressions: Number of turns in first group $= k \sin a$; number of turns in second group $= k \sin\left(a + \frac{2\pi}{n}\right)$ number of turns in third group $= k \sin\left(a + \frac{4\pi}{n}\right)$, etc., k being a constant, a being any chosen angle and n being the number of groups.

Recent Electrochemical Developments.

ELECTRIC FURNACE INVENTIONS.

F. J. Tone, of the Carborundum Company, has patented a method of heating carbon articles (brushes, electrodes, etc.), which, like the manufacture of carborundum, belongs to that class of electric resistance furnace methods in which the current is passed along a definite path (the "resistor"), thus localizing the heat. While in the carborundum furnace the charge (which is a non-conductor of electricity) is packed around the carbon resistor, this is not done in the case of carbon articles which are conductors. Mr. Tone arranges them in groups or masses without interposed insulation, and separates them from the resistor by an air space which later on is filled with gaseous products of the driving off of volatile matter. Since there is no direct contact between the resistor and the carbon articles, the heat is conveyed to the latter by convection and radiation.

D. A. Holmes, S. A. Tucker and E. Van Wagenen have patented an arc electrode consisting of zirconium carbide admixed with a suitable binding material, such as coal tar or molasses. The flame arc between two such electrodes is said to give "a light of exceptional brilliance when compared with arc lights of other kinds which are subjected to the same conditions of temperature (or voltage and current)." The zirconium carbide is prepared in an electric furnace from the mineral zircon admixed with an excess of carbon. In this connection it may be mentioned that according to reports from Germany zirconium is the material of the filament lamp which is about to be placed on the market.

Three patents granted to F. J. Machalske refer to the treatment of phosphate rock. Rock containing tricalcium phosphate is crushed and mixed with sodium chloride and carbon and the mixture is heated in an electric furnace to a temperature sufficient to decompose the rock, and effect the production of phosphoric chloride and calcium and sodium carbides. The phosphoric chloride is treated with water for the production of phosphoric and hydrochloric acid. The calcium-sodium carbides may be treated with water for the production of acetylene, calcium hydroxide and sodium hydroxide. If the above electric furnace process is carried out in an atmosphere of nitrogen the carbides combine with the nitrogen to form cyanamides, which may be treated with water for the production of calcium and sodium carbonates and ammonia, or they may be mixed with sodium carbonate and smelted in an electric furnace for the production of sodium cyanide.

ELECTROLYTIC PROCESSES.

The treatment of copper-nickel matte for obtaining the two metals separately is a subject of considerable industrial importance. While, as a matter of fact, the (non-electrochemical) Orford process is reigning supreme at present, yet quite a number of inventors have attempted with more or less success a solution of the same problem by electrolytic methods. A. G. Betts (the inventor of the lead refining process) has recently patented a method in which the electrolytic deposition of the metals is combined in a peculiar way with storage battery engineering. The first step of the Betts process is the same as in the Browne process: the copper-nickel alloy is used as anode in a cell containing an acid solution of copper sulphate, and copper is deposited upon the cathode. The electrolyte thereby

becomes richer in nickel and a certain proportion of it is, therefore, withdrawn at intervals and replaced with fresh solutions of copper sulphate. The part withdrawn is first freed from copper and other impurities until only pure nickel sulphate remains. This is electrolyzed with an anode of spongy lead, whereby nickel is deposited on the cathode and the lead plate changes partly into sulphate, like the spongy lead plate of an accumulator during discharge. This plate is then used as cathode against a half-discharged lead-peroxide plate and as anode in a sulphuric acid solution; in other words, we have here a half-discharged accumulator which is recharged. As is well known, the solution thereby is enriched in sulphuric acid, while the plates are changed to spongy lead and peroxide, respectively. The spongy lead plate is used again as described above, while the lead peroxide plate and the concentrated sulphuric acid are used with a nickel-copper alloy electrode, this combination representing a primary cell, i. e., electrical energy is generated while the nickl-copper alloy dissolves, and the lead peroxide is partly changed into sulphate. The solution thus obtained is returned to the copper-depositing tank. The process is, therefore, "regenerative as regards the sulphuric acid used, and partly so as regards the electrical energy used."

A second patent recently granted to A. G. Betts relates to the arrangement of the electrodes in an electrolytic refinery. Up to the present two different systems have been used, the multiple system and the series system. While the latter is employed in only two large refineries, it has been able there to hold its own against the older and more widely used multiple system. As a matter of fact, it seems that neither system has a decided advantage over the other. Mr. Betts employs in a single tank in electric series sets of electrodes arranged in multiple, whereby he claims to obtain most of the advantages of both systems. The depositing plant then becomes more in the nature of a flooded floor on which the operations are carried out than the usual large number of individual tanks.

I. E. Lewis and J. A. Corey have patented mechanical details of construction of tanks for electrodepositing metals and particularly for the production of printers' electrotypes.

A modification of the usual methods of electrolysis of sodium chloride has been patented by A. S. Ramage. The cathodic product is caustic soda, as is usually true, while at the anode the hydrochloride of aniline is used as depolarizing agent. The effect is two-fold: the e.m.f. required by the cell is reduced and anilin-black is obtained at the anode as valuable by-product. Various modifications are mentioned by the inventor.

New Chicago Office of Postal Telegraph-Cable Company.

The Postal Telegraph-Cable Company, on Easter morning, moved its Chicago main offices, and the headquarters of its entire Western division, from the location which it had occupied in the Stock Exchange Building for the past ten years, into the Rialto Building, which block, made two stories taller and renovated from top to bottom, is now known as the Postal Telegraph Building.

GENERAL VIEW OF POSTAL TELEGRAPH COMPANY'S OPERATING DEPARTMENT, CHICAGO.

The main operating room, occupying the tenth and eleventh stories of the building, is lighted by 110 windows—practically light on all four sides. The room is 170 ft. long by 67 ft. wide, with a 24-ft. ceiling. It furnishes seating capacity for 472 operators and is the most modern large operating room in the world. The switchboard, of the latest pattern, and mounted on slate, is composed of eleven sections, each section accommodating fifty wires, making a total of 550 main line wires.

The room presents a brilliant appearance at night, being lighted by 60 6-cluster electroliers, with latest improved reflectors, and also 35 side gas light chandeliers. Owing to the hundreds of typewriters

in use (all messages being handled direct from the wire on typewriters, no pencil, pen or ink being used in the office) it is essential that the lighting arrangement should be so perfect that no shadows shall be thrown on the typewriter keys, as the striking of the wrong key by an operator might cause an error that would result in great loss or inconvenience to patrons.

Each of the 118 quartette tables is provided with four cabinets, for the care of typewriters, and each table is equipped with the newest and best machinery and apparatus known to the art. A special feature of the table equipment are the new resonators containing the sounders for the use of operators receiving on the typewriters.

Fifty duplexes and sixty quadruplexes are provided to take care of the through traffic and the leased wires of the company, while 100 single Morse sets are allotted to the traffic on way and city wires. There are fifteen sets of single-wire repeaters, ten sets of direct point duplex repeaters, used on through wires. Every table is connected up independently, and so arranged that it can be worked in any and every combination that the division chief in charge desires.

The basement terminal pin-jack arrangement is the first of its kind installed. It facilitates the testing of cables to locate trouble, and by a system of cords any one cable can be cross-connected without a moment's delay, bringing the wires to the switchboard in their regular place.

In addition to the basement terminal there is a cross-connecting frame immediately behind the switchboard, with a capacity of 7,000 wires, and in the gallery over the switchboard is another cross-connecting frame of similar capacity, the switchboard being connected to both cross-connecting frames with 25-conductor and 50-conductor cables. It is possible, with this improved system of transfer, and the connecting frame, to change the location of sets, loops or wires, without breaking a single connection.

The pneumatic tubes, known as the transfer tube system, in the main operating room, consist of twenty terminals, and are used for distributing messages to different parts of the great room, to the general offices, the bookkeeping, delivery, receiving, file and other departments in the building and also to both floors of the Board of Trade Building, the office of the Associated Press, and to outside branch offices.

To handle these tubes an air compressor with capacity of 1,000 cu. ft. of free air per minute, and three large tanks arranged for 12, 5 and 2½-pound pressure, have been installed. The heads on each tube are of the latest modern type, with automatic valves, controlled electrically, and arranged so that should any one tube be interrupted the companion tube can be used to send messages either way. The air is released by inserting a carrier, and when the carrier leaves the tube at the opposite end it automatically cuts off the air. This system, therefore, gives the company continuous service twenty-four hours a day at a minimum cost, there being no power consumed except when the tube is put in service.

The main terminal of the messenger call box system is located in the business office on the ground floor. This equipment is of the latest and improved type, and is installed in accordance with the Postal Telegraph Company's new system.

In the basement of the building are located the dynamos, motor-generators, switchboard and air compressors. The dynamo switchboard, 25 ft. long by 8 ft. high, is constructed of Maine slate; the switches are mounted direct, the bus-bars and general wiring being of bare copper bars.

The plant consists of 25 motor-generators, arranged for day and night service. While the Chicago Edison Company furnishes the power, and also provides an emergency load, the Postal Company has also installed engines and dynamos of sufficient capacity to take care of its service in the event of interruption to the Edison service. This is necessary to insure continuous service at all times.

Especial attention has been given to the comfort and convenience of employes. There is a circulating library, reading room, smoking room, locker and rest rooms for both men and women, and an up-to-date restaurant, open day and night. For the messenger boys quarters are fitted up in the basement, containing the latest improved toilet, wash rooms, bath rooms, shower baths and reading room, play room and gymnasium, and later on it is the intention to provide evening classes for the boys, and lectures by electrical experts and well-known educators for the benefit of the older heads.

The moving of this vast plant from the Stock Exchange Building to the new Postal Telegraph Building was effected without the least interruption to business, and was accomplished without any breaking of circuits. Indeed, the fact that the office was being moved was unknown to any outside office having wire connection with Chicago. It was begun at 3 o'clock Easter morning and completed by 7 a.m., and Monday morning the hundreds of operators, clerks and messengers took their respective places in the new building and business was handled without hitch or delay, in spite of the fact that this day, on account of the May wheat excitement on the Board of Trade and the financial difficulties of the Milwaukee Bank, brought the company the largest business of any Monday in its history.

The work of arrangement, wiring and fitting up of the offices was begun nearly a year ago, under the supervision of E. J. Nally, general superintendent; T. W. Carroll, electrical engineer; C. L. Bennett, his assistant in charge, and F. W. Conger, superintendent, and a staff of expert engineers and electricians. Mr. Carroll had full charge of the wiring arrangement of the operating room, terminal rooms, power plant, cable and pneumatic tube systems, and to him is due the credit for the highly satisfactory manner in which the equipment was installed, and the successful way in which the gigantic task of the removal was accomplished.

New Telephone Patents.

ART OF ELECTRICAL WAVE TRANSMISSION.

For a long time circuits for transmission were designed in a hit or miss fashion, one effect after another being stumbled upon and here and there some point of importance worked out in a general way. With the appearance of Dr. Pupin's loaded circuit papers and patents, there was given a great impetus to the art, with the result that many developments have followed each other with great rapidity. The distortionless circuit founded upon distributed shunts appeared and many different arrangements of distributed inductances and capacity, sometimes these latter introducing the distortionless principle. All this of course has extended the practical range of the transmission of speech. Nevertheless, even with the best efficiency of transmission there is a limit to practical transmission, as the energy sent out to the line at the sending station is small. Many efforts have been made to overcome this by introducing new energy as needed, all these attempts being centered in the telephone repeater, but none has been practically successful, although repeaters have employed every agency from the crudest mechanical contrivances through liquids, compressed air, even to the attenuated gases of the mercury arc converter.

A new idea of adding energy is embraced in a scheme proposed and patented by Mr. C. D. Ehret, of Washington, D. C. This is

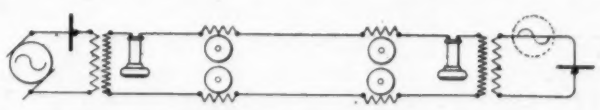


FIG. 1.—EHRET LOADED CIRCUIT.

founded on the peculiar action of the asynchronous generator. Such a generator is merely an induction motor with its short-circuited squirrel-cage armature mechanically driven at over synchronous speed, and its field energized by alternating current.

The alternating field current is supplied upon the line at all times, and is of a frequency too high to be of material effect in disturbing transmission. The telephone currents are impressed upon this high frequency current through induction devices and affect the maximum values of successive alternations such that the crests of these picture the telephone wave. As these pass through the field of the asynchronous generator, after becoming attenuated through the effect of the various line losses, energy is added in proportion to the modified waves. Of course, any distortion will be amplified at the same time. Because of this the circuits must be arranged to reduce this distortion to a minimum by the aid of leakages and inductances. The diagram of Fig. 1 may give a better idea of the arrangement.

NOVEL JACK AND PLUG.

A rather novel jack and plug invented some time ago, although but recently patented, is shown in Fig. 2. These were designed with the idea of reducing the spacing of jacks to a minimum. It will be seen that the plug has no ball or tip of the usual sort, but that the tip contact is a cup within which one of the jack springs extends to make

contact with its walls. The plug never came into practical use, which seems rather fortunate, as it is easy to imagine the plug cup

FIG. 2.—DEAN PLUG AND SPRING JACK.

the seat of all sorts of refuse from wads of paper up.

MAGNETO BELL.

A magneto bell especially designed by the inventor, C. H. North, of Cleveland, Ohio, for selective signaling purposes, is shown in Fig. 3. The armature is hung to span a single spool electromagnet,

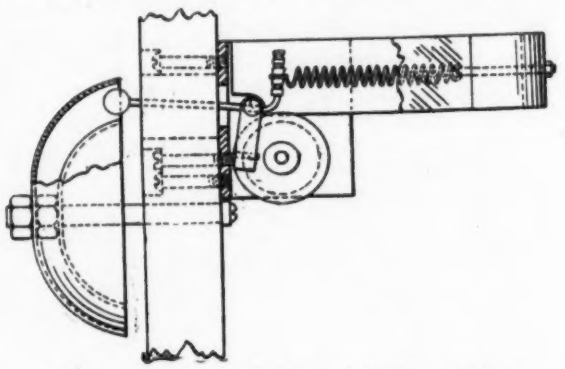


FIG. 3.—NORTH SELECTIVE SIGNALING DEVICE.

being polarized by the U-shaped permanent magnet. The gongs are of different diameters and are mounted one within the other with the bell tapper between them. The North Electric Company has obtained the patent for this bell by assignment.

COMBINED DROPS AND JACKS.

Recently mention was made of a combined drop and jack, the invention of C. T. Mason, of Sumter, S. C., in which the entering plug served to push a metallic ball from its path, to the end that the shutter of a drop associated therewith was restored. There is now at hand a patent granted to the same inventor for another combination working on this same principle. In this new apparatus the drop shutter falls in, leaving exposed an aperture in the face strip. As the plug enters the thimble, it forces a ball against the shutter to restore it.

Two other styles of combined drops and jacks have been brought out by Mr. Mason, the patents for these as for the others being assigned to the Sumter Telephone Manufacturing Company. One of these is mechanical, a shoulder of the plug shank serving to restore the shutter, which in this case is a tongue of metal which falls through a slit in the drop strip to signal attention. The other is electrical, the restoration of the shutter being accomplished by opening the auxiliary contacts of a locking coil, thus de-energizing it and permitting the shutter to return to its normal position from gravity.

TRANSMITTER.

The solid-back transmitter of White has owed its success not only to the delicate proportioning of its parts, but to the auxiliary mica diaphragm which seals the carbon chamber and yet permits of free motion of the front electrode. Mr. H. P. Claussen has gone one better, by using two auxiliary mica diaphragms, one for the front and one for the back electrode. The walls of the button have no inflexible support, being carried solely upon the peripheries of the auxiliary diaphragm. The front electrode is attached to the main diaphragm as usual, while the back electrode is secured to the bridge. Mr. Claussen has assigned the patent for this invention to the American Electric Telephone Company.

CABLE TERMINAL.

F. B. Cook, of Chicago, has patented a combined cable terminal and housing. The terminals of the head are those of fuses and carbon plate arresters, which are mounted upon its sides. The cable enters the bottom of the head. The cover of sheet metal is cylindrical and may be elevated to expose the terminals for inspection.

LETTER TO THE EDITORS.

The Fractional Value of π

To the Editors of Electrical World and Engineer:

SIRS:—It is a matter of consideration that in the primary school the student is taught that the value of π is 3 1/7, or 22/7. When he subsequently enters upon the more advanced branches of mathematics, or takes up engineering problems, he finds that the above value is inaccurate, and therefore substitutes the value 3.1416. This latter is the commonly accepted value of π, although it is merely inaccurate to a less degree.

The magic calculus shows the true value of π to be 3.1415926535+, so that the above values are correct to two and four decimal places, respectively. It is worthy of note that the vulgar fraction, 3 16/113, or 355/113 is equal to 3.14159291+, which thus represents π correctly to six decimal places. In view of the fact that this latter fraction represents π to such a high degree of accuracy it would be better to have the student early taught its use in preference to the more inaccurate one, for, once having acquired proficiency in its application to mathematical problems, there will be no occasion to change to some other representative numbers in after years.

CHICAGO, ILL. GEORGE L. SMITH.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Large Alternators of Liberal Design.—An illustrated account, by Gaillard, of tests of the 5,000-kw, 11,000-volt, 25-cycle, 75-r.p.m., steam-driven alternators, installed in the Manhattan power station of the New York Subway (see our last issue, page 893). In another short article Wilson deals with the construction of these alternators. In commenting on Gaillard's paper, B. G. Lamme points out some advantages of the liberal design of these machines. For instance, the measured iron loss is less than ⅓ of the amount fixed by the contract specifications. The result is that each machine is an example of a machine primarily rated at 5,000 kw, but which could be rated at probably 7,000 kw with as much margin as is found on ordinary machines. The liberal capacity of this machine is due partly to the fact that a fly-wheel type of generator was chosen with a very large fly-wheel capacity. This necessarily requires the machine to be of very large dimensions, so that the design electrically and magnetically could be made very liberal, as the dimensions were fixed very largely by mechanical considerations. Therefore, while the purchaser bought a machine of a nominal rating of 5,000 kw and paid a high price per kilowatt on account of the enormous dimensions, in return for this investment he obtained a machine having an abnormal overload capacity. The purchaser, in the case of the Manhattan machines, has therefore obtained a much better machine than he contracted for, and he has since given it a 20 per cent. higher nominal rating. Considering, therefore, the value of the floor space saved, the increased rating permissible, and the higher performance of these machines, there is no doubt that the investment has been better than if the usual type of generator had been bought. These machines were guaranteed to run in parallel at all loads specified in the contract; no situation has yet been found where they do not fulfill this condition; they run together perfectly at no load, full load or 100 per cent. overload. They run in parallel with one-half the engine disconnected, and have been so operated at various times. The angular variation in each revolution is extremely small, as is shown by sighting through the rotating parts of two of the machines when they are running in parallel. This perfect parallel operation is due partly to the heavy dampers on the field poles, and partly to the large fly-wheel capacity, with good engine proportions. The short-circuit armature current with normal no load field current is somewhat over three times full load armature current. Such proportions give an extremely good regulating machine, but there are accompanying disadvantages. As a rule the larger the current the machine can give on short-circuit, the more disastrous will be the effects of

such short-circuits. For the operation of rotary converters, where each machine in itself furnishes some regulating element, it is a question whether there is any advantage in having generators with such good inherent regulation. Experience shows that machines which give 1½ times full load current on short-circuit, will operate rotary converters in practically the same manner as those which have twice this ratio, and at the same time the effect of a short-circuit on the system will be less destructive. The only consideration of importance in generators having 15 or 20 per cent. regulation would be the parallel operation. If they have ample dampers on their poles and their prime-movers have sufficiently uniform rotation, they will operate in parallel perfectly. With turbo-generators these machines operate in parallel almost independently of their regulation, as the turning effort is uniform.—*Elec. Club Jour.*, May.

Alternating-Current Series Motor.—CREEDY.—A paper read before the British Institution of Electrical Engineers. The author first gives the theory of the series motor by means of a circle diagram, and then discusses with the aid of his formulas the method of designing a series motor. He compares briefly the design of the alternating-current and of the direct-current series motor. In both machines the number of armature turns determines the flux, and the dimensions of the field magnet, the number of turns which will be required on it to give this flux. In the alternating-current motor, as soon as these quantities have been determined, there is practically ascertained the impedance of the machine as well. The resistance of the direct-current motor, on the other hand, is not determined by the numbers of turns on the field and armatures, since it may be given any value by putting a corresponding amount of copper on the machine. Thus in the alternating-current motor, since the impedance is determined by the number of field and armature turns, there are not so many independent variables as in the direct-current machine, and consequently the limits of good design are much narrower. The weak point of his method of design is that there is no method of determining the self-induction of the armature from its dimensions; it seems necessary to have recourse to approximate formulas. The author then gives an account of a series of experiments made with a motor. They verify his theory. Some of the special facts shown by the experiments are the proof that there is a certain number of field turns which give a maximum power factor; curves showing the effect of change of frequency and the effect of the number of field turns on the output and efficiency. To throw some light on the commutation of the motor, a number of experiments were made with the aid of a Duddell high-frequency oscillograph. His curves show something of the actions going on in an alternating-current series motor, although they afford no indication as to how to obtain good commutation. The author found, however, that by using a very low current density in the brush a moderately hard carbon (not too hard), he was able to get perfectly satisfactory commutation in his motor for all frequencies up to 35, currents up to 30 amp., and speeds up to 3,000.—Lond. *Elec.*, April 21 and 28.

Cross-Section of Magnetic Circuit of Transformers.—MÜLLER.—Arnold and La Cour have formulated the rule that for a given flux and volume of iron of a transformer, the hysteresis loss becomes a minimum if the maximum flux density is equal in all parts of the magnetic circuit. In proving this rule they assumed that the eddy current losses are negligible compared with the hysteresis losses. The present author shows that this assumption is not necessary, and that the above rule is the condition of the minimum of the total iron or losses, whatever may be the ratio of the eddy current losses to the hysteresis losses.—*Zeit. f. Elek.* (Vienna), April 16.

Variable-Speed Motors.—BRESLAUER.—A communication with respect to a suggestion made at the end of Bate's paper, which was abstracted in the Digest last week. Bate advocates the use of double-wound armatures, one side having half the number of effective conductors carried by the other. The present writer has designed and constructed motors on these lines successfully several times, but only for low voltages. This is worth mentioning, because of the serious danger connected with the fact that at the top speed—where only the armature with half the number of conductors is working—the other side will assume double voltage, amounting to the dangerous pressure of 1,000 volts when 500 volts are supplied.—Lond. *Elec.*, April 28.

Heating of Electric Apparatus.—KADE.—An article giving formulas and describing a graphical method for determining the final temperature of an electric apparatus which is loaded at regular intervals. *Elek. Zeit.*, April 13.

Spark Transformer.—WALTER.—A description of a transformer devised as a substitute for the induction coil in exciting Röntgen ray tubes. The leading characteristics of the transformer are the large number of turns in the secondary and the closed magnetic core.—Lond. *Elec. Rev.*, March 17.

Single-Phase Railway Motors.—LATOUR.—A paper discussing the relative advantages and disadvantages of the ordinary series motor, the repulsion motor and the compensated motor without phase difference for single-phase traction.—*L'Eclairage Elec.*, April 29.

Effect of Silicon on the Magnetic Properties of Iron.—See the abstract under "Electrophysics and Magnetism."

POWER.

Utilization of Blast Furnace Gases.—ROSSI.—The conclusion of his article on the utilization of blast furnace gases for the generation of electrical energy, especially in connection with the problems of electric smelting. At the end of the article the author gives a tabulation of the various estimates which have been made by different authors on the energy available from the surplus of blast furnace gases over all requirements of the blast furnace. These estimates vary between 468 and 868 hp per ton of pig iron made per hour. If all the surplus blast furnace gases in the United States should be utilized there would be available between 1,000,000 and 2,000,000 hp. The figure calculated by the author from Gayley's data in his dry blast run (with only 1,726 pounds of coke per ton of iron) is 724 hp available per ton made per hour.—*Electrochem. and Met. Ind.*, May.

Vacuum and Steam Engine Economy.—NEILSON.—Having discussed in former articles the means for superheating steam and the influence of superheating on engine economy, the author now discusses the general aspects of the economy of using condensers.—*Eng'ing Mag.*, May.

Compressed Air in Mining.—Various illustrated articles on the use of compressed air in mining and metallurgy. An article by Weightman deals with the electrical compression of air.—*Mines and Minerals*, May.

Swiss Power Plant.—A note stating that the counties of Schwitz and Zuerich have made a contract for the erection of a large power plant supplying both counties with electricity. By building a dam a reservoir with a capacity of 96,500,000 cubic meters will be obtained. The difference in the level of this reservoir and the Zuerich Sea is 480 meters.—*L'Industries Elec.*, April 10.

Electricity in Textile Mills.—A full account of recent discussions on this subject before the New England Cotton Manufacturers' Association.—*Eng'ing Record*, May 6.

TRACTION.

Electricity Versus Steam for Heavy Haulage.—ARMSTRONG.—A careful analysis of the cost of operating electric and steam locomotives on steep grades. The author points out the economy of the electric equipment, as well as other advantages. While the wholesale retirement of the steam locomotive in favor of its electric competitor is a dream of the far distant future, there are many isolated sections of steam roads in the operation of which the electric locomotive could effect economies which would well pay for its adoption. These economies may be in the direction of a reduced fuel, labor and maintenance account, but may be much more far-reaching, and warrant changes in the present method of operating by steam locomotives. The millions of dollars contemplated for reducing the gradients and double-tracking certain sections of single-track roads, in order to increase their capacity with steam locomotives, might be spent with promise of greater return if used for installing electrical equipment.—*St. R'y Jour.*, May 6.

Tramway Statistics.—A note on some statistical data given by Garcke at the general meeting of the Metropolitan Electric Tramways in London. The company runs its lines electrically and has a controlling interest in the lines of the North Metropolitan Company within the County of London, which are run by horse traction. While the receipts per car-mile on the horse lines amounted to 21.6 cents, the corresponding figure for the electric lines was 26.6 cents; but the receipts per annum in the first instance were $40,000 per route-mile, whereas with electric traction they were $70,000. No data are given as to the respective costs of working.—Lond. *Elec.*, April 21.

Electric Locomotive.—CSERHATI.—A long illustrated description of the new electric locomotives which have been ordered from Ganz & Co., and which have already been referred to in the Digest.—*Zeit. f. Elek.* (Vienna), April 9 and 16. A shorter illustrated article on the

same subject in *Eng. News,* May 4.

One-Motor Equipment.—PRICE.—A communication calling attention to the fact that in deciding whether to use one or two motors per truck on a double-truck car, it is important to consider the efficiency of the brakes. The writer points out the difficulty of properly braking a short-wheel base truck with a one-motor equipment.—*St. R'y Jour.,* May 6.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Incidents in the Operation of a Large Plant.—STOTT.—An account of several incidents which occurred in the Seventy-fourth Street plant and transmission system of the New York Interborough Rapid Transit Company. These instances are described and some lessons are drawn from them. Electrically-driven boiler feed pumps, air pumps, exciters and circulating water pumps, are not advisable in a power plant from any point of view, as they form a link in a chain, the failure of any one of which links may be the means of shutting down the entire system. Investment, thermal efficiency and reliability all indicate steam-driven auxiliaries for power plants. All cables must be so installed that a short-circuit between phases or between phases and ground cannot establish an open-air arc; or in other words, the arc must be confined to as small a space as possible, such as inside a tile conduit or iron pipe. Static dischargers as ordinarily installed are incapable of handling large rises of potential when backed by a large amount of power. They may readily be the cause of great delay in restoring power after they have burned out. In order to install enough static dischargers it would often be necessary to put up a separate building to contain them, and, as this is not generally feasible, it may be better to remove them entirely. The armature bars should be sufficiently supported outside the iron to stand the dynamic forces of repulsion and attraction where the coils or end connectors are parallel to one another. This has been very successfully overcome by the author by means of a hardwood blocking.—*Elec. Club Jour.,* May.

Electricity in Agriculture.—KLIPPE.—An account of a paper read before the Hamburg Electrical Society. The electric motor is now used for various purposes on large farms. At several places in Germany the electric motor is employed for ploughing; the equipment which has been found most suitable is analogous to the Fowler steam plow. Electric motors are used to a large extent for threshing. Those central stations which supply various farms over a large area have not proven a profitable investment up to the present. The reason is that the current is sold for power purposes at only 3¾ cents per kw-hour, while the author thinks that the farmer could easily pay 5 or 6 cents. Statistics have shown that the consumption of electric current for lighting is small, the following figures being given: the energy consumed per cp-year is, in farmhouses, 0.8 kw-hour; in taverns, 1.4, and in sugar factories, 2.2. The lamps usually installed in the country are of 11 cp rating. It is stated that the farmer likes to install a great many lamps, but uses them very little. The author points out that central stations supplying a great many farmers have much expense for current distribution and cannot turn out to be profitable if they charge only 3¾ cents per kw-hour for power and 12½ cents for illumination. He thinks that the price for light could not be increased, but a good discount should be allowed for long hours of burning. On the other hand, energy for power purposes should not be sold for less than 6 cents, and a discount should be allowed for a high load factor.—*Elek. Zeit.,* April 6.

Central Station Costs.—KNOWLTON.—An analysis of central station operating costs and revenue based on the recent report of the Massachusetts Board of Gas and Electric Light Commissioners. Several comparative tables are given, and it is pointed out that there are very large differences in different cities of approximately the same size. "That electric lighting as a business is still in a transition stage is evident from a study of these data." The wide discrepancies between the different companies' showings prove beyond question that there is room for the practice of expert engineering in bringing a higher standard of efficiency to the front. In the light of modern scientific progress, there would seem to be no need of such tremendous differences in the cost of generating, distributing and selling electricity for power and lighting in communities less than 200 miles apart.—*Eng'ing Mag.,* May.

ELECTROPHYSICS AND MAGNETISM.

The Effect of Silicon on the Magnetic Properties of Iron.—BAKER.—A note on researches which he has made as to the effect of silicon on the magnetic properties of iron. For the purposes of these experiments there were prepared five samples of iron, in one of which impurities were only 0.158 per cent., silicon accounting for 0.024 per cent. The other samples had practically the same composition except for silicon, of which there were about 1, 3, 5, 7½ per cent., respectively. Mechanical tests were made and the microstructure examined, so as to compare chemical constitution, mechanical qualities, microstructure, permeability and hysteresis at the same time. The magnetic result of adding silicon up to 7½ per cent. seems to be that the permeability at lower densities is increased, while the magnetization curves bend over more suddenly, so that saturation is reached at a lower density; in other words, the knee of the curve gets more and more rectangular. At the same time the hysteresis loss appears to be less. Unfortunately, Baker's comparison of hysteresis is based on results obtained at the same maximum, H, viz., 25. But owing to the change of the form of the curve, the B for this H varies from 16,250 in the purest sample to 14,450 in the 7½ per cent. silicon; the hysteresis loss in the latter case is only 53 per cent. of the former. As, however, it is B rather than H which is a measure of the physical reality, it is to be regretted that the results do not enable a comparison of the hysteresis at the same B's. It is clear that if the value of B in both samples were carried up to, say, 14,000, the hysteresis loss in the high silicon alloy would be much less than in the nearly pure iron—a very striking result. The permeability seems to be improved by the addition of silicon as far as 7½ per cent., with a value of B up to at least 12,000. The addition of the silicon produces a profound difference in the crystallization of the iron; the crystals, which become larger with the increase of silicon, are regarded as "allitrimorphic crystals of a solid solution of iron and what is probably a definite silicide of iron." It is to the increased size of these crystals that Baker looks for an explanation of the magnetic effects. With 4 per cent. and upward of silicon the alloys are extremely brittle; but up to 3 per cent. the mechanical effects are comparatively small.—From the *Jour. of the Brit. Institution of Elec. Eng.;* abstracted in Lond. *Elec.,* April 28.

Special Steels.—GOLDSCHMIDT.—The first part of an article on the effects of vanadium and titanium on steel.—*Electrochem. and Met. Ind.,* May.

Spontaneous Ionization of Air in Closed Vessels.—WOOD.—To explain the "spontaneous" ionization of air in closed vessels, the hypothesis has formerly been made that it is due to the action of a penetrating radiation constantly passing through the atmosphere in all directions. The present author has studied carefully the causes of the ionization, and reaches the conclusion that it has at least a three-fold origin, part of it being due to a penetrating radiation from the outside, part to a secondary radiation from the walls of the vessel excited by the former, and part to an intrinsic radiation from the walls completely independent of the external radiation. The existence of this last part is very important from its bearing on the question of the radioactivity of ordinary materials. The author found that each metal gives out a specific intrinsic radiation, the amount of which varies very much in different metals. This is strong evidence in favor of the view that all matter is radioactive.—*Phil. Mag.,* April.

Radioactivity.—MCCOY.—An account of experiments which show that the total alpha ray activity of any uranium compound is strictly proportional to its percentage of uranium. This is a direct confirmation of the general theory that radioactivity is an atomic property.—*Jour. Am. Chem. Soc.,* April.

ELECTROCHEMISTRY AND BATTERIES.

Analysis of Refined Copper.—HEATH.—A full review of the various chemical and electrochemical methods now employed in large technical laboratories for the complete analysis of refined copper. A simple form of rotating anode to be used with cylindrical platinum cathodes is described.—*Jour. Am. Chem. Soc.,* March.

Thermochemistry.—RICHARDS.—In a continuation of his serial on metallurgical calculations, the author discusses the use of thermochemical data, and illustrates his explanations by various examples from metallurgical practice.—*Electrochemical and Met. Ind.,* May.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Mirror Type of Indicating Instruments.—PREUSS.—An illustrated description of a method for increasing the scale deflection for small angles of deflection of the mirror. The method is based on the use of a second mirror, as shown in Fig. 1. *A* is the usual little mirror

which rotates with the deflected portion of the apparatus. *B* is the second curved mirror. On account of the reflection of the two mirrors,

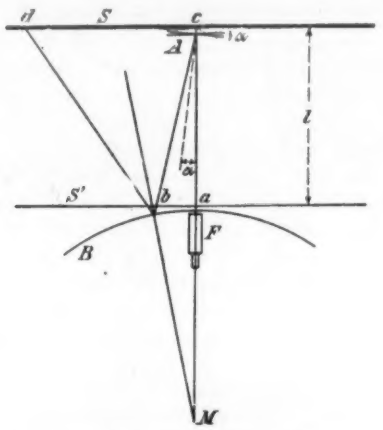


FIG. 1.—INDICATING INSTRUMENT.

A and *B*, the scale deflection, *c d*, is obtained on scale *S*. *F* is the telescope. Under equal conditions, the usual method would give a deflection, *a b*, on the scale *S'*. The deflection *c d* is proportional to the angle of deflection, if the cross-section of the mirror, *B*, with a plane through the scale *S* is circular, the center, *M*, of the circle being situated on *c a*, or its prolongation. The mirror, *B*, may, therefore, be convex or concave. Its surface may be a cylinder or a globe.—*Elek. Zeit.*, April 27.

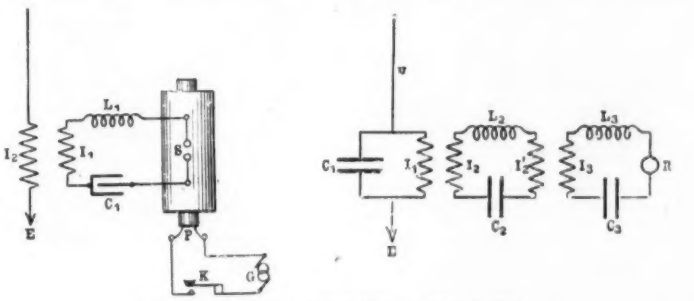
Sextant Electrometer.—GUINCHANT.—A description of an electrometer in which the needle is charged by induction, and is suspended by an insulating fibre instead of a conducting one. The directing couple is given by a bifilar suspension or a small magnet. There are six sectors, placed in the same plane under the needle. The latter is a plate of silvered mica strengthened with strips of mica. Two of the sectors are larger than the others, and form a kind of figure eight, filling an angle of some 80° on each side of the center. The other sectors are smaller and farther away. The needle in its normal position covers the whole of the central sectors and about a third of the outer ones. The theory of the instrument is the same as that of the quadrant electrometer. An outer sector, the needle and half a central sector may be considered as forming a system of two condensers in cascade. The author expects to get a deviation of 1 mm. per millivolt on a scale at 1 meter.—Lond. *Elec.*, April 14; *Comptes Rendus*, March 27.

Helium Tubes as Wave Indicators.—DORN.—The author has found that vacuum tubes filled with helium are very sensitive to electromagnetic disturbances. The tubes may be used for the determination of dielectric constants by Kinkelmann's method, and also for Nernst's method of comparing capacities at high frequencies.—Lond. *Elec.*, April 28; from *Ann. d. Phys.*, No. 4, 1905.

Electrodynamometer.—PATTERSON.—A mathematical article in which the author calculates the torque between the two coils of an absolute electrodynamometer in which two single-layer coils are employed. He considers the effect which the asymmetry of the leading wires might produce, and also the effect of the earth's magnetic field, with a view to the elimination of these effects from the final result.—*Phys. Rev.*, May.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Interference in Wireless Telegraphy.—STONE.—A paper read before the Canadian Society of Civil Engineers. The author thinks that the simplest way of preventing interference is to cause each transmitter to send out its signals by means of persistent trains of simple harmonic waves of a frequency materially different from that employed by any other transmitter within operative range of the receiving station with which communication is to be maintained, and to make each receiver responsive only to persistent trains of simple harmonic waves of the frequency employed by the transmitter with which it is in communication. When in the transmitter a high degree of persistency, a pure sine wave and a great amplitude of oscillation are desired, the spark-gap is removed from the ordinary vertical oscillating circuit, and a simple harmonic e.m.f. is impressed upon the vertical oscillator in its place. The resulting vibrations in the vertical oscillator are then forced simple harmonic vibrations. In order that they may be of great amplitude, the frequency of the impressed force is made to correspond to the fundamental of the vertical oscillator or to one of its harmonics, in which cases the reactance of the vertical oscillator is nil. A simple arrangement for producing forced, simple harmonic vibrations in the vertical oscillator is shown in Fig. 2, in which *G* is an alternating-current generator, *K* is a key, *P* shows the connection to the terminals of the primary of a spark coil, *S* is a spark-gap between the terminals of the secondary of the spark coil, C_1 is a condenser, L_1 is an inductance, I_1 and I_2 are the primary and secondary coils of a high-frequency transformer, and *E* is the earth. The receiver shown in Fig. 3 permits the receipt of persistent trains of simple harmonic electromagnetic waves of a predetermined frequency to the exclusion of messages transmitted by similar waves of materially different frequencies, and without interference by impulsive waves. In this arrangement the receiving device, which is indicated at *R*, is placed in a local circuit, $C_3I_3L_3R$, made resonant to the frequency of the waves to which the station is intended to respond, and a second resonant circuit, $C_2I_2L_2I_2$, resonant to the same frequency and called a "weeding-out circuit," is interposed between the first-mentioned circuit and the vertical oscillator. The branch circuit, consisting of the coil I_1 and the condenser C_1, is not, when taken by itself, resonant to the same frequency as the other local circuits, but is so proportioned that



FIGS. 2 AND 3.—WIRELESS TELEGRAPHY.

when connected as a branch circuit, forming a part of the vertical oscillator system, the latter shall respond most energetically to persistent trains of waves of that frequency falling upon the vertical wire.—Lond. *Elec.*, April 28.

Wireless Telegraphy in Germany.—An account of the regulations issued by the German Post Office for the public use of wireless telegraphy in Germany.—*Elek. Zeit.*, April 27.

Party Line System.—A fully illustrated description of a new party line telephone system devised by Arnheim, which does not use a code of ringing signals, nor can any subscriber cut in and listen to or take part in the conversation of another subscriber. Each party line terminates at a selector switch, to which all the subscribers' instruments are connected. When one of the subscribers wishes to use the line, he depresses a button and removes his telephone from the hook. This sets the selector switch automatically so as to connect his instrument to the line, and leaves the other subscribers disconnected, and the rising of the button shows him that he is through to the line. The subscriber then rings the exchange. Should any other subscriber try to get in while the first subscriber is still on the circuit, his button does not rise after it has been depressed, showing that the line is engaged. The automatic switch works in such a way, however, that his instrument is connected to the line as soon as the first subscriber clears by hanging up his telephone. In connection with the instruments at each operator's position at the switchboard is a "selector disc" having in it a number of finger holes corresponding to the number of subscribers on the party line. To ring up one of the subscribers, the operator, having plugged the jack in the usual way, places her finger in the hole marked with the subscriber's number, and pulls the disc round. This sends a number of impulses corresponding to this number to the automatic selector switch already referred to, which connects the subscriber in question to the line. In an editorial note on the subject, the advantages of the system are recognized, but it is pointed out that this system introduces, almost of necessity, another disadvantage, namely, that the subscribers to the same party line are debarred from communicating one with another.—Lond. *Elec.*, April 14.

Automatic Signals.—TAYLOR.—An article on automatic signal and safety systems as applied to electric railways. The writer calls attention to the more obvious weaknesses of the present signal systems, and summarizes the details of one which he considers would answer all the requirements of street railway service.—*St. R'y Jour.*, May 6.

Hamburg.—Craemer.—A note on a paper read before the Hamburg Elec. Soc. on the new underground telephone cable network in Hamburg. The new exchange will serve an area of 115 square miles with about 23,000 subscribers. Great topographical difficulties are met in installing the cables.—*Elek. Zeit.*, April 6.

MISCELLANEOUS.

British Institution.—Mr. John Gavey has been nominated as president of the British Institution of Electrical Engineers for the session of 1905-6. Born in 1842, he has been connected with British and transatlantic telegraphy since 1860, and in 1902 became, on the retirement of Sir William Preece, engineer-in-chief of the General Post Office in London.—Lond. *Elec.*, April 28.

Exhibition.—Breisig.—A very lengthy illustrated description of the various apparatus and machinery which were exhibited at last year's exposition of the Berlin Elec. Soc., on the occasion of its twenty-fifth anniversary.—*Elek. Zeit.*, April 20.

BOOK REVIEWS.

Elektro-Ingenieur-Kalender, 1905. By Arthur H. Hirsch and Franz Wilking. Berlin: Oscar Coblentz. 314 pages. Price, 2.50 marks.

This little German yearly pocket-book or almanac for electrical engineers has now appeared for the fifth time. It has been able to hold its own against the older, more voluminous and widely known Upperborn Kalender, mainly for the reason that the authors of the new publication have successfully avoided duplication of matter contained in Upperborn and have, nevertheless, collected a great amount of data useful for engineers. The chief aim of the authors has been to collect such data as a consulting engineer needs when away from his desk or library. For instance, when called upon to report of the development of a water power for electrical purposes, he finds on page 92, under turbines, a list of 17 points concerning which he should gather as much information as possible while on the spot, since he will need this information later on when working out his report.

The data given in the book are concise and to the point, often in the form of tables and formulas, and sometimes illustrated by diagrams. The book in its new edition has been brought up-to-date and corrected and revised in details. Since it is based upon German engineering conditions, it is, of course, more valuable to German than to American engineers, yet the latter should also find much information of value. There is no American book of just this kind on the market.

Die Berechnung Elektrischer Leitungsnetze. Vol. II. By J. Herzog and C. Feldmann. Berlin: Julius Springer. 451 pages, 216 illustrations. Price, 12 marks.

This is the second and concluding volume of a textbook, the first volume of which has already been published, and has also been reviewed by us. It is remarkable that the book should have been written by two authors in different countries. The first volume had its preface written jointly from Budapest and Köln, the second from Budapest and Darmstadt.

This volume contains eight chapters, devoted to the following subjects:

I. The general proportioning of conductors in direct-current systems.
II. The drop of pressure and energy in conductors.
III. The heating of electric conductors.
IV. The economic principles in the design of electric conductors.
V. The determination of conductors for alternating and other systems.
VI. The determination of closed conducting networks.
VII. The proportioning of conductors in long-distance transmissions.
VIII. Conductors for central stations.

The style of the authors is very clear and is abundantly illustrated by numerical examples. The treatment is much more full and complete from the algebraic standpoint than in any other textbook on the subject with which we are acquainted. We can recommend the book to all students of the technology of electric transmission and distribution.

Die Prufund von Gleichstrommaschinen. By C. Kinzbrunner. Berlin: Julius Springer. 390 pages, 249 illustrations. Price, 9 marks.

This book of 393 pages, with 249 figures, is a manual for testing direct-current dynamos and motors. It is the development of a course of lectures given at Manchester to technical students, and is intended for the use of students and those employed in testing laboratories.

The author goes very minutely into every detail, although in one or two places the language could have been more exact to prevent possible misconstruction. It is very commendable for a textbook of a first-year student in laboratory work and answers this purpose well. It would also be a good guide for the electrical mechanic in a central station, who, owing to his scanty knowledge, has to look up the details of circuit connections and precautions before attempting a test he may be called upon to perform. However, the man who is employed constantly in testing all kinds of electrical machinery is expected to know most, if not all, the methods. For him the mere enumeration of the order in which the different data should be determined is desirable and all the other material wasteful, so far as consuming time is concerned, and superfluous.

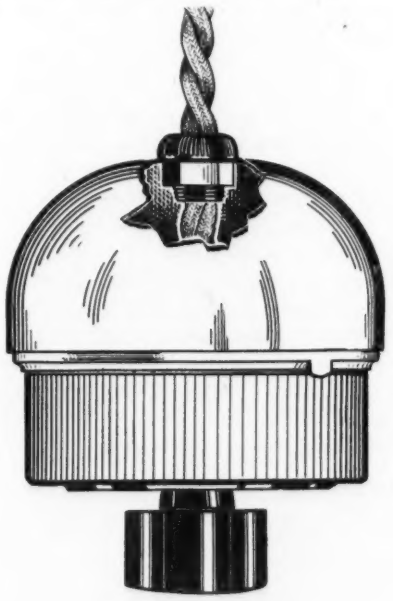
The subject is handled in many respects similar to the method used in American textbooks. It is divided into eleven chapters, whose main subjects are: Resistance, temperature, insulation and speed measurements; the determination and construction of load and no-load diagrams, magnetic measurements, such as determination of leakage coefficient, etc.; efficiency and practical tests and separation of internal losses.

An appendix treats on the operation of direct-current machines and troubles arising in practical service.

The book is neatly gotten up, and is published by the well-known firm of Julius Springer, Berlin.

A New Pendant Switch Device.

Owing to the restrictions of the inspection rules in many cities, which do not permit a single-pole switch for the control of arc lamps or large clusters of incandescent lamps, the use of the pendant switch, which is largely of the single-pole variety, has been limited to a greater degree than its usefulness would warrant. By the employment of the canopy illustrated, however, a snap switch of the ordinary variety may be readily converted into a pendant switch, which is adapted to as broad a use as is the snap switch itself. The canopy is the product of the G. & W. Electric Specialty Company, 128 West Jackson Street, Chicago. It consists simply of a compressed metal cap designed to fit neatly over the base of the snap switch. Two screws passing through the base of the switch secure the cap by means of a properly-designed cross piece. The entering wires are brought in through a rubber bushing, and support the switch by means of a knot on the inside. The device is nickel-plated and



PENDANT SWITCH.

when mounted on a switch the whole presents a very attractive appearance.

At the present time canopies are manufactured for Hart switches, both of the 5-amp., single-pole and the 10-amp., double-pole type. The device will no doubt find strong favor with users of arc lamps in stores.

In wholesale establishments and stores where it is impracticable to locate the switch near the arc lamp, it has heretofore been necessary to place all the switches in a cut-out cabinet at one end of the room. With this arrangement all the lamps must be switched on at once, although only the ones in the vicinity of the salesman and his customers are required. By the use of a double-pole pendant switch attached to each lamp, the separate lamps may be turned on and off independently, as the salesman may desire, and the lighting bill will consequently be greatly reduced.

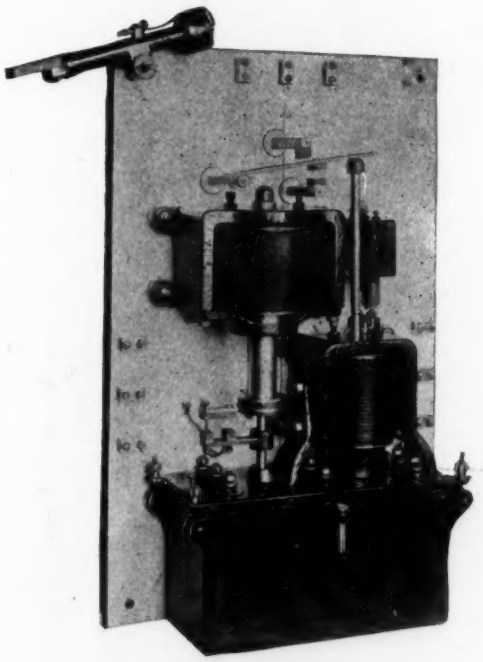
The expense of installing the pendant switch is much less than that of wiring to a position on the wall in most cases. With the type of switch shown the cost of the canopy is but a fraction of the cost of the standard snap switch.

The pendant switch is, moreover, a very convenient accessory in many places in residences and stores. It can be used to control lights in closets, bedrooms, show cases and other similar places where it is inconvenient to have a switch in a permanent position.

There are also many places where clusters can be provided with pendant switches and switched independently of the remaining lights on the circuit, thus effecting a saving in actual current.

An Automatic Starter for Induction Motors.

We illustrate herewith one of the several types of automatic starters and speed controllers for induction motors recently brought out by the American Electric & Controller Company, 136 Liberty Street, New York City. The starter includes an auto-transformer,



AUTOMATIC STARTER.

not shown in the cut, and which may be mounted at the back of the panel or located in any other convenient place, and is designed for starting and stopping induction motors of the squirrel-cage type.

The cut shows the apparatus set to the "M" position for the motor running. A float switch, as shown in the upper left-hand corner, a pressure gauge or thermostat having electrical contacts, or any suitable device acts at the proper time through a small relay at the right of the large upper solenoid, to trip a latch and causes the main switch to open, at the same time leaving the circuits ready for starting again. To start the motor the large upper solenoid is first energized, which lifts the plunger and rod; the latter throws the auto-transformer switch, at the same time cutting off the current in the solenoid, thus allowing the plunger to fall very slowly by gravity against the retardation of the dash-pot. The transformer switch in the meantime remains closed long enough to permit the motor to reach full speed. The plunger has then fallen to its lowest point, makes the connection which energizes the lower solenoid and closes the main switch across the line, throwing out the transformer switch by the same movement, thus completing the cycle.

The starter for the slip-ring type of motor is similar in principle, but the plunger of the large upper solenoid carries a cross arm which makes sliding contact with a straight-line set of contacts connected to a grid resistance in the circuit of the motor secondary. The lower solenoid shown in the cut is dispensed with altogether. A device may be added to the slip-ring type of resistance starter, making it possible to hold the cross arm and plunger at any desired point along the row of contacts, thus making it serve as an automatic speed regulator as well as starter.

Nernst Lamp Street Lighting in New England.

The wide streets of the residence portions of many New England towns, with their rows of magnificent shade trees, render the use of the arc light for street illumination undesirable, but, on the other hand, afford an excellent field for the Nernst lamp. With this lamp placed below the foliage and at less intervals than practicable with arc lights, an ideal street illumination is possible, and this advantage has been fully realized in the case of a number of street installations in New England towns.

An illustration is furnished at West Hartford, Conn., where the Hartford Electric Light Company has installed 224 single-glower street lamps. The 60-cycle current, supplied both for the house and street lighting of West Hartford, is generated at the main power plant of the Hartford Electric Light Company, at Tarriffville, fourteen miles away. From there it is transmitted at a pressure of 11,000 volts, three-phase, to the sub-station in Hartford. Here it is stepped down to 2,400 volts single-phase and is carried over two-wire mains to West Hartford, four miles distant. Then the current is again lowered to 230-115 volts pressure for the Nernst and Edison lamps, respectively, by means of 5-kw transformers with three-wire secondaries, the neutrals of which are grounded.

One of the outside wires supplying the Nernst lamp is led through

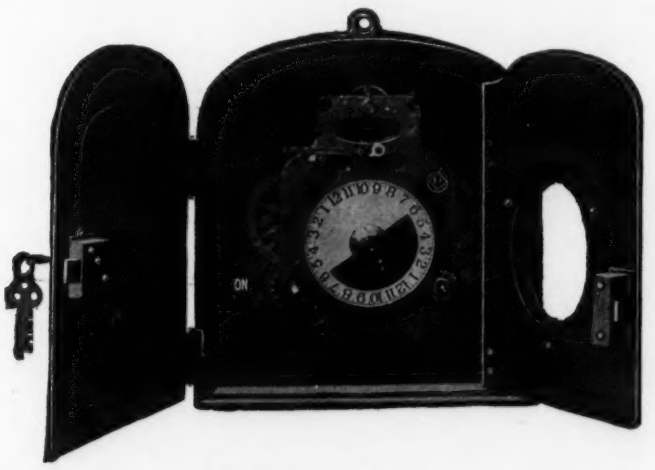


FIG. I.—TIME SWITCH.

a time switch which may be set to throw the lamps on or off at any desired time. The primaries of the transformers are fed through single-pole, high-tension fuses, lightning arresters being used on the mains only at the Hartford sub-station. The lamps are grouped on thirteen separate circuits, the number of lamps on each varying from ten to twenty-eight, and each circuit being supplied from a 5-kw transformer, centrally located. The lamps are mounted at an elevation of about 20 ft. on standard goose-neck brackets, such as are used in series incandescent, and on alternate poles with a regular spacing of 200 ft. While originally equipped with clear globes, these are gradually being replaced, as they become broken, with opalescent globes, as the latter seem to give the best results.

The system is regularly patrolled each day before 8 a.m. and after

4.30 p.m. by three boys mounted on bicycles. Each boy carries in a suitable case a number of repaired holders with which he replaces any burned-out holders he may discover. The latter are returned to the maintenance department for repairs.

In addition to this repair work, all the inspection and repairing necessary to be made with the Nernst installations in the city of Hartford amounting to a total of about 2,500 glowers is done by a young man connected with the lighting station. The records kept by the company indicate that the total average cost for maintenance of the commercial and street lighting system amounted to $1.26 per glower for the first six months of the past year. This represents the most recent data available. The exact cost of the street lighting

FIG. 2.—NERNST STREET LAMP.

maintenance cannot be determined, as this was not kept separate from the commercial lighting records.

The regulation is said to be within 5 per cent; that is, 2½ per cent either side of normal, and the life of the glowers is found to be slightly in excess of 800 hours on an average. As No. 6 wires are used for the secondaries, there is no appreciable drop between any transformer and the most distant lamp on the circuit. The lights are supplied for $18 per lamp-year on an all-night schedule of 3,750 hours, whereas 60-cp gas units would not be furnished under $27 per year, using artificial gas at $1 per thousand cubic feet.

That the system is giving excellent satisfaction to all concerned is evidenced by the fact that the company has been asked to install eighteen additional street units in the near future.

The villages of Unionville and Farmington, distant thirteen and nine miles, respectively, from the city of Hartford, both have Nernst street lighting systems similar to that in West Hartford, and are supplied with current from the power plant located at Unionville.

Although not over 200 hp in capacity, this plant is strictly up-to-date in its design and equipment. The normal lighting load of 80 hp is supplied from a 75-kw, three-phase generator driven by a water turbine. An extra steam-generating unit with sufficient capacity to carry the normal load of the station is held in reserve. The three-phase, 60-cycle current is transmitted at 2,300 volts from the station to the step-down transformers in both villages, over three No. 4 main conductors; and the transformers, which are mostly of 10 kw capacity, are connected to these mains through General Electric high-tension cut-outs and Wurts lightning arresters. The line has also the usual lightning protection at the station.

Both the Nernst street lamps and the commercial Nernst and Edison lamps are supplied from these transformers through three-wire, 112-224-volt secondaries of No. 8 gauge, giving a maximum drop of eight volts from the transformer to the most distant street lamp, with a regulation of 3 per cent from normal.

The system with a total of 188 single-glower lamps is divided up into six circuits of approximately 28 lamps each; of the total, 77 lamps are used for street lighting in Unionville, 86 for street service and 25 for commercial service in Farmington.

The street lamps are mounted similar to those in West Hartford on standard goose-neck brackets at an average elevation of about 20 ft. with a spacing of from 125 to 375 ft. between lamps depending upon the location.

All the lamps are inspected and the necessary renewals made by a boy once every two days. The glowers are allowed to burn out their natural life and the complete records show an average life of 803 hours with a total cost of maintenance per lamp-year, including labor, interest and depreciation, of $2.80, or 8½ mills per kw-hour.

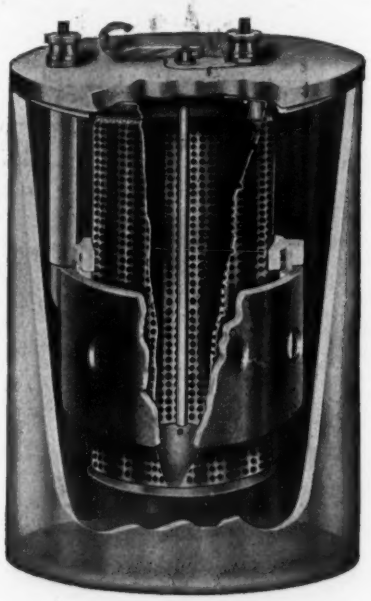
"Challenge" Primary Cell.

An improved form of the Lalande-Chaperon form of primary cell is being placed on the market by the Challenge Manufacturing Company, 365 Market Street, Newark, N. J., under the name of the "Challenge" battery. The electrolyte is a 20 per cent solution of caustic soda. The positive electrode is formed of specially selected, clean copper scale, which is subjected to an oxidizing process which transforms every particle into black oxide of copper. The negative electrode is of zinc, which is amalgamated when cast. A special oil of high flashing test and which will not saponify in the solution, covers the upper surface of the electrolyte. The cell is adapted for both closed and open-circuit work.

The general form of the cell is illustrated in Fig. 1. A perforated container is permanently secured to the cover. To this container are also permanently secured two porcelain separators which are for the purpose of holding the zinc element in proper position; one of these porcelains also acts as an insulator for the connection from the zinc to the outside of the cover. This connection is a copper rod which passes through the insulator and cover and is secured by a knurled thumb nut which holds the zinc rigidly in position. It will be seen that the zinc does not rest on the porcelains, but is drawn up against them.

The container has a loose, displacable bottom of copper, which is dished up and fits against the lower end. Secured to the bottom is a copper rod which passes up through a bushing in the cover. A hook latch is arranged on the upper end of the rod, and when in the position shown locks the bottom securely in position. The container holds a charge of oxide of copper of special form and the rod referred to acts as the positive pole of the cell; a binding nut for this positive pole is located close to the hook latch. The container is also provided with a permanent metallic connection to this binding post. The threaded zinc connection is new in each renewal, thus insuring perfect contact at the binding post; and as this connection is not exposed to the solution there is no local action. It will be observed that there are no soldered joints in this form of construction to be attacked by the solution.

When it is necessary to renew the cell the hook latch is pulled



"CHALLENGE" PRIMARY CELL.

slightly forward and turned upward. The bottom will then drop down about two inches. The thumb nut is removed from the zinc connection, allowing the remains of the zinc also to fall away. If now the cover with the container attached is turned upside down in the hand, the bottom will swing to one side (owing to the hinge formed by the latch pin), allowing ample space for refilling the container with new oxide. When the container is refilled the hook is pulled down and pushed slightly forward, thus replacing and lock-

ing the bottom again in position. A new zinc is placed in position with its connecting rod passing through the insulator, and the binding nut tightened. The cover is now ready to be placed on the jar, the elements, which are suspended from it, being both renewed and ready to be immersed in the fresh solution. In going through these operations the hands do not come in contact with any part that has been in the caustic soda solution, and it takes only one minute to make a renewal, the result being valuable time saved and absolutely clean hands when finished.

"Decade" Resistance Boxes.

The obvious advantages of "Decade" resistance boxes and the increasing demand for them have led the Leeds & Northrup Co., of Philadelphia, to offer a new line of this type of Wheatstone bridges and resistance boxes. The illustration shows a resistance box having four rows of resistances ranging from one ohm to 10,000 ohms in the rheostat, and with six resistances in the bridge, all of

"DECADE" RESISTANCE BOX.

which may be used in either arm. This box is fairly representative of the line. A perspective view of the box is here given.

The advantage of the "Decade" plan of connecting the coils in the rheostat over that of the regular "post office" or other plug-out methods may be briefly summarized as follows:

Each "Decade" requires but a single plug, which is never out of use, being either in the zero position or set on some value. It is consequently not easily lost by being laid aside.

Since each "Decade" requires but one plug, the values can be read directly from the position of the plug without the mental process of adding up a series of values as in the 1, 2, 3, 4 or the 1, 2, 2, 5 plan of connections.

It is worthy of note that no block in the rheostat ever has a plug fitted to two sides of it. This prevents the possibility of a good plug fit being disturbed by the removal of a plug from the other side of the block. It is a very decided advantage in insuring good contacts and accuracy. In making measurements with resistance boxes of the 1, 2, 3, 4 or other plug-out arrangements, it is necessary to run over the plugs after a balance has been obtained, to insure good contacts. This is particularly the case in medium-priced boxes where the blocks are small. This is not at all necessary in the form of "Decade" box illustrated.

In this line of boxes there is a unique arrangement of the bridge arms, which minimizes errors due to contacts and facilitates interchanging the arms. By this arrangement, any one of the coils in the bridge may be connected to either bridge arm. The bridge can consequently be reversed and the coils interchanged very simply and easily.

The resistances are made of wire which has an exceedingly low temperature coefficient and requires no correction at all for accuracies to 1/10 of 1 per cent for all ordinary changes of temperature. The wire has also a negligible thermo-electric force against copper and consequently no corrections have to be made in using it.

An unusual thickness is given to the hard rubber top for this class of apparatus, in order to prevent the possibility of buckling and to insure continued good plug fits.

Fort Wayne Induction Integrating Wattmeter.

The Fort Wayne Electric Works has developed a new single-phase integrating induction wattmeter, known as Type W, shown in Fig. 1 with cover removed. The instrument occupies a space 8 3/16 by 7 1/16 by 4⅝ in. and weighs less than ten pounds complete. The interior construction is, as will be seen, exceedingly simple and compact, but with ample space all about the operating parts. It is easily

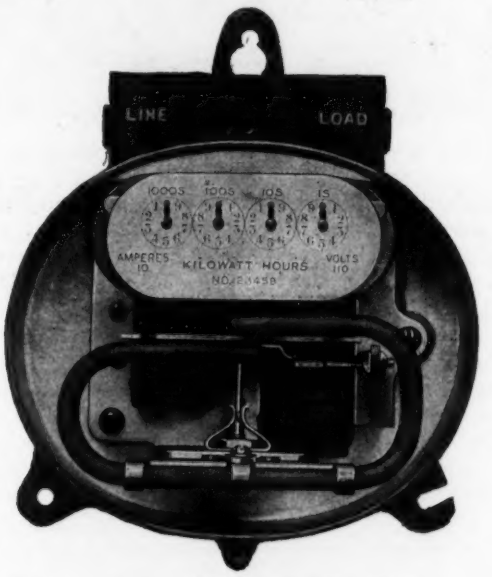


FIG. 1.—WATTMETER WITH COVER REMOVED.

assembled or dismantled, and its operation and adjustment is so simple as to be readily understood by the ordinary meter man without expert training.

All connections with the line are made inside a separately sealed terminal box on top of the meter (Fig. 3), to binding posts effectually

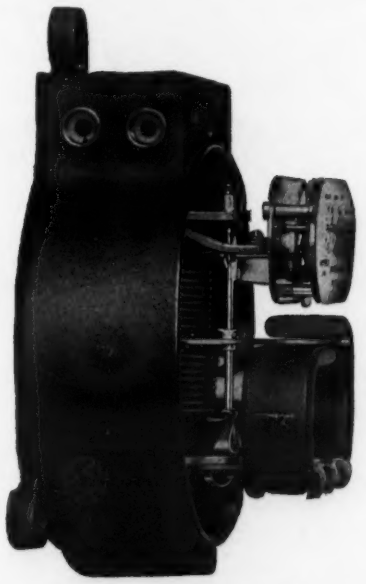


FIG. 2.—PERSPECTIVE VIEW OF METER.

protected from accidental short-circuits. No shunt circuit wires need be extended and no soldered connections need be made outside the meter. Both sides of a two-wire circuit or the outside wires of a three-wire circuit pass through the terminal box.

An easily read, four-dial register is mounted on slotted projections held by two screws to the dial bracket on the mechanism frame,

assuring accurate alignment with the rotating element. No constants are necessary and the smallest reading is in kilowatt-hours. The integrating train is composed of a minimum number of finely finished working parts, reducing friction to the lowest point.

The upper bearing for the rotating shaft is inverted, the end of the shaft being hollow and rotating about a stationary flexible tempered steel needle mounted in the top bearing stud. This flexible feature eliminates noise of vibration, and the hollow top of the shaft

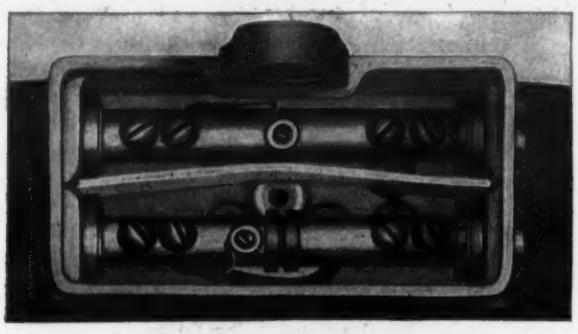


FIG. 3.—TERMINAL BOX.

permits lubrication if desired, without the possibility of oil being drawn to the worm wheel by capillary attraction. It also permits more freedom of motion to the upper end of the shaft without liability of permanently bending the upper bearing. The inside of the phosphor-bronze shaft forms a tiny bearing collar encircling the needle so that friction is practically absent and no lubrication is really necessary. Fig. 5 shows the upper bearing, and the lower bearing with shaft on jewel and the jewel free from shaft.

The rotating element is a small light-weight aluminum disc mounted on a short phosphor-bronze shaft and held in place on the shaft by a set-screw in a collar in the disc. It can be adjusted vertically very readily to permit adjustment with the air-gap of the magnet.

The jewel screw is the only movable part of the lower bearing.

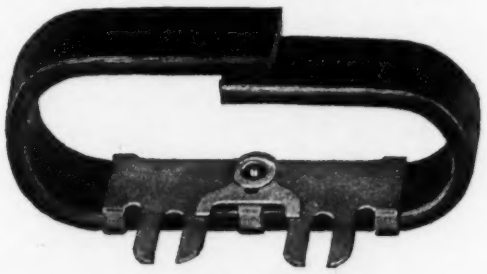


FIG. 4.—DRAG MAGNET.

The lower end of the phosphor-bronze shaft has set into it a small hardened-steel tip with rounded end. This tip bears on a sapphire jewel elastically supported on a carefully adjusted spring mounted in the jewel screw.

For relieving the jewel from pressure when not in operation, the

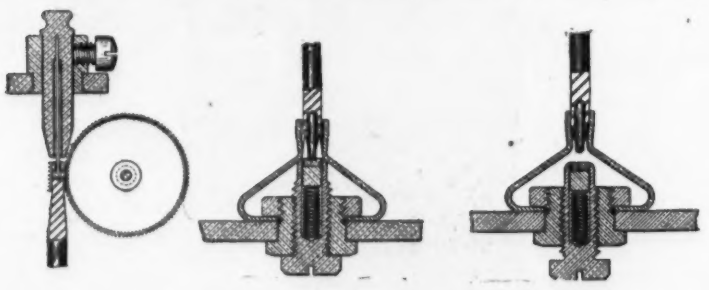


FIG. 5.—SECTIONAL VIEWS OF BEARINGS.

jewel screw is simply withdrawn slightly, allowing a spring clamp to close on the shaft and hold it in place until the jewel screw is again tightened, forcing the spring to release the shaft. The advantage of this clamp is that it acts horizontally and exerts no strain on either the bearing or the shaft.

The permanent or drag magnet is in front of the shaft, as shown in Figs. 2 and 4. It is attached to the lower bearing bracket by two screws engaging with slotted lugs on the magnet clamp. Its position with relation to the center of the disc is maintained by a sliding gauge, which can be locked. After the gauge is set the magnet may be removed and replaced freely without further adjustment, as the gauge is a part of the magnet clamp and is not changed by the removal of the magnet.

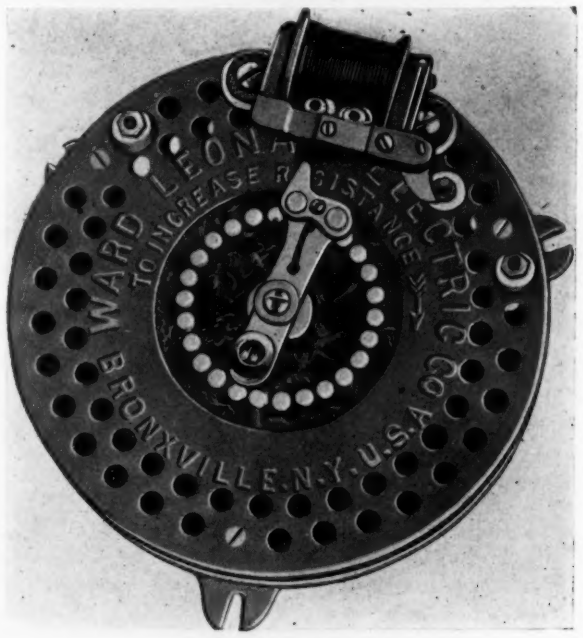
The two series coils are fitted to spiders, each attached to the main frame with a single screw and located opposite the shunt coils in the back of the meter. For three-wire circuits they are double-wound to avoid the effects of unbalanced loads.

The shunt coils are mounted on the upper and lower arms of the magnetic circuit. The meter for 60-cycle circuits has a lagging connection on the outside of the lower shunt coil for 60 cycles only. The 140-cycle meter has a 140-cycle lagging connection on the upper shunt coil in addition to the 60-cycle connection below, and can be altered for use on the lower frequency. The meters are wound for 110 and 220 volts and two or three-wire service, and are made for four different ampere capacities, 5, 10, 20 and 40, without transformers.

The light load adjustment is made by shifting a copper plate in the magnetic path or air-gap of the motor magnet in which the disc revolves. The movement is made by a micrometer screw in combination with a guide bar. A small set-screw locks this adjustment.

Variable-Speed Motor Field Rheostat.

The accompanying illustration shows a motor field rheostat designed for the control of variable-speed motors. It is equipped with a no-voltage release protective device which prevents the starting of the motor under condition of weakened field. If a motor is started under weakened field, the consequent overload through the motor will blow the fuses and tend to change the circuit. It is not practicable to depend upon the operator to cut out all field resistance before each starting of the motor, nor is it always possible or con-



FIELD RHEOSTAT.

venient to have the rheostat an interlocking part of the motor starter. The operation of the rheostat is as follows: An ordinary motor starter may be mounted upon the wall, anywhere near the machine. The field rheostat, which is the speed controller, may be mounted directly upon the motor or machine driven. Upon opening the line switch to stop the motor, the field rheostat "no-voltage" magnet is de-energized, its armature is released, and it falls and short circuits the resistance of the motor field rheostat. Upon re-starting, the motor is necessarily started with its full field strengh. By moving the field rheostat lever to the "no resistance in" position, the armature of the no-voltage release magnet is raised, the short circuit is removed, and the resistance of the field rheostat can then be cut in circuit to obtain the speed changes desired.

New Westinghouse Apparatus.

As the public has become familiar with the characteristics of incandescent lamps, the importance of having those with filaments of high efficiency and of replacing them when this efficiency has been impaired with use has gained general recognition. Users have learned to discriminate, both in purchase and use, between lamps which are economical in consumption and those which are not. As a consequence, dealers who carry large stocks of incandescent lamps generally find it advisable to test lamps from lots received before putting them in stock, in order to be able to give customers positive assurance regarding their performance. It has also been found of advantage to make occasional tests of lamps in use in office and public buildings and other places where large numbers are installed, in order to determine whether it would be economical to replace them with others having new filaments.

With the more frequent testing there has arisen a demand for a standard instrument especially adapted for this work, and the Westinghouse Electric & Manufacturing Company has accordingly designed a lamp-testing instrument which will fulfill the requirements of the dealer who must handle rapidly large numbers of globes, and of the electrician who wishes to test, one at a time, lamps at different points, and who must, therefore, have a portable instrument whose design is such as to permit of its being quickly inserted in the circuits and rapidly detached therefrom.

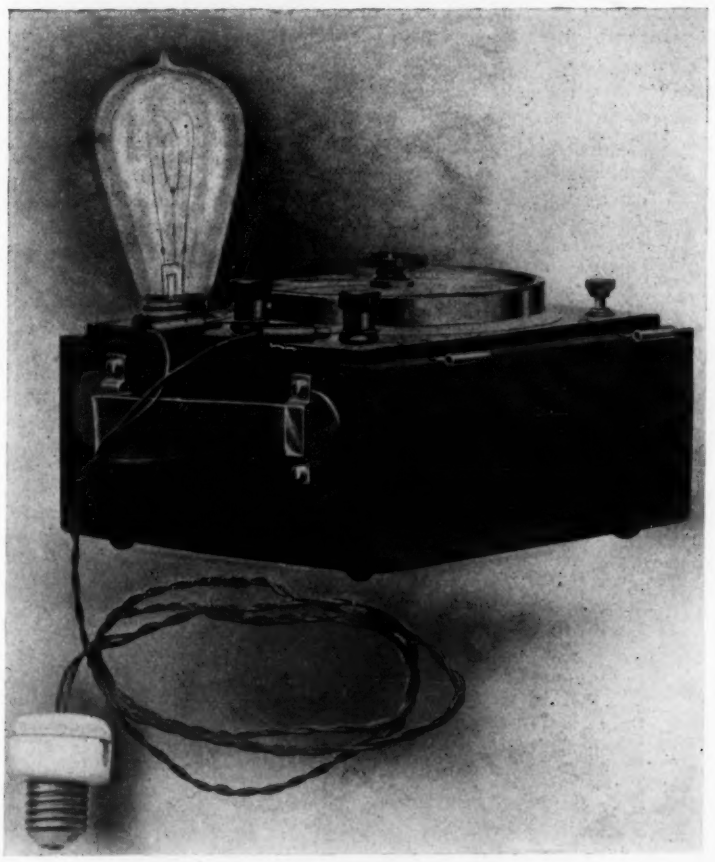


FIG. 1.—LAMP-TESTING INSTRUMENT.

In general design, construction and finish, the Westinghouse lamp-tester's volt-wattmeter is similar to the other portable instruments manufactured by this company. In effect it is a portable wattmeter, provided with a socket or receptacle for the introduction of the lamp to be tested, and with a switch for cutting out the series windings, in order to enable the instrument to be used also as a voltmeter, operating on the voltage winding alone. Connection is made by means of a pair of leads, the upper ends of which unite in a plug, to be screwed into the lamp socket on the lighting circuit, and the lower ends being provided with terminals for attaching to the binding posts. It requires but a moment to make the connection. When used in lighting installations, the lamp to be tested is removed from the line and inserted in the receptacle on the volt-wattmeter, which is then connected to the socket from which the lamp was taken, and a test is made under the actual conditions which are found to exist in service.

Two concentric scales are provided, one indicating volts and the other watts, and by use of the switch which cuts the series winding in or out of the magnetic circuit, the wattage of the lamp or the voltage of the circuit may be read. This is a feature not possessed by any other lamp-tester's instrument, and makes it unnecessary to carry a voltmeter. Lamp-testing instruments heretofore designed have been wattmeters only, and it has been necessary to use voltmeters in connection with these wattmeters to obtain reliable results, as the watts vary more rapidly than the square of the voltage, and it is insufficient to know merely the value of the watts which are consumed by the lamp.

The instrument may also be used either as a voltmeter or a wattmeter independently of its lamp-testing function, which gives it an additional value and adopts it for general testing purposes. It is suitable for use on either alternating or direct currents without change of calibration. Reverse readings are not necessary on direct currents.

The Westinghouse volt-wattmeter combines the advantages of portability, ease of manipulation, long range of readings and extreme accuracy. It is mounted in a polished mahogany case 6¾ x 7¾ x 4¾ in. and has a removable cover. The scale is very long, with large open divisions, easy to read. The action is dead-beat. The instrument operates on electromagnetic principles, having two light, movable coils connected to the indicator, and four stationary coils connected in series, the arrangement being such as practically to neutralize the self-induction of the system. It is not affected by external fields or changes in frequency, and has powerful springs giving ample governing force. It has a maximum capacity of 150 volts and 150 watts, which is ample for the service for which it is designed.

The well-known Westinghouse Electric & Manufacturing Company Wurts non-arcing arrester has been in service now for over twelve years, and it is notable in this connection that the first changes in its mechanical mounting have only recently been found desirable. The old type of this arrester is used extensively both here and abroad, and for all conditions of service ranging through power, lighting, telephone service on high-tension transmission systems and wherever adequate protection has been desired within its range.

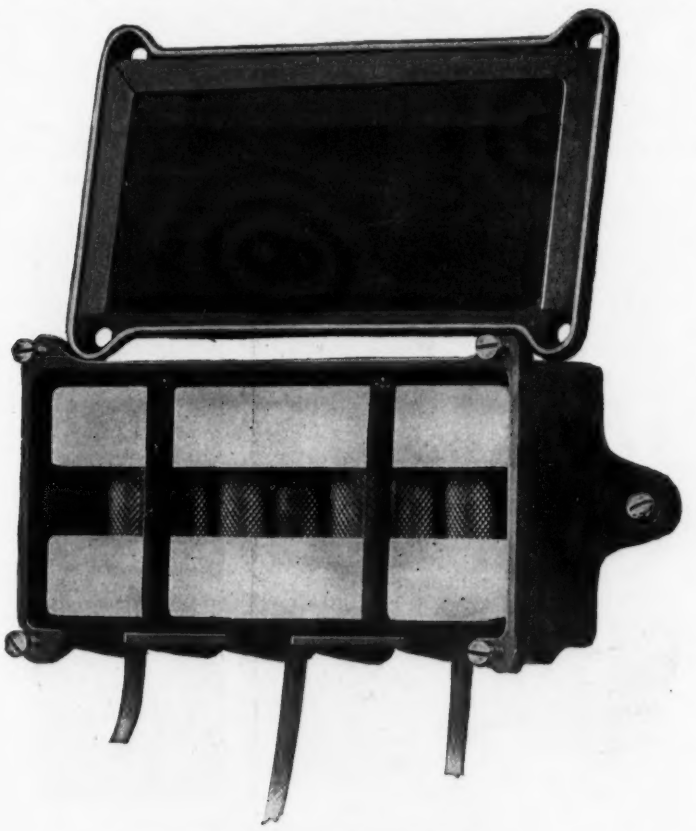


FIG. 2.—LIGHTNING ARRESTER.

The new arrester has the same dimensions as the old type, and the unit itself may be used as a repair part wherever the latter device has been employed. One improvement is the method of securing the non-arcing cylinders to the porcelain supports. These

are firmly held in place by machine screws passing through holes in the porcelain supports and screwed in the line and ground contacts. Porcelain supports are moulded to shape with the cylinder centers exactly spaced, thus securing a perfect air-gap adjustment. All the cylinders can be easily turned through any angle to present new surfaces for action. Line and ground leads are made in a very secure manner.

The assembled porcelain supports and cylinders are separated from the iron box by rubber-covered wire. This makes an effective

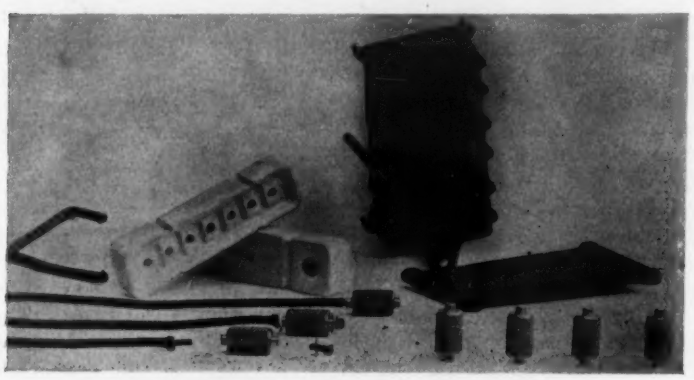


FIG. 3.—IMPROVED LIGHTNING ARRESTER.

packing which insures the porcelain from breakage if the arrester be shaken or jarred, and the wire holds the packing in place. The cover is screwed to the box, rubber gaskets keeping out all rain. The arrester is of the line type designed for connection to overhead feeders and circuits, the normal rating being from 500 to 1,250 volts double pole and up to 2,500 volts single pole.

All the best electrical operating characteristics of the old type of arrester are retained, the changes consisting of improved mechanical construction and consequently longer life, and ease of inspection and repair.

In order to meet the demand for a very compact and inexpensive circuit breaker for both alternating and direct-current circuits, the Westinghouse Electric & Manufacturing Company has produced the "Type F" breaker described below.

This type of circuit breaker is made in 12½, 25, 50 and 75-ampere sizes for 250 volts direct and 440 volts alternating. They are made in the overload type only. The tripping point is adjusted by

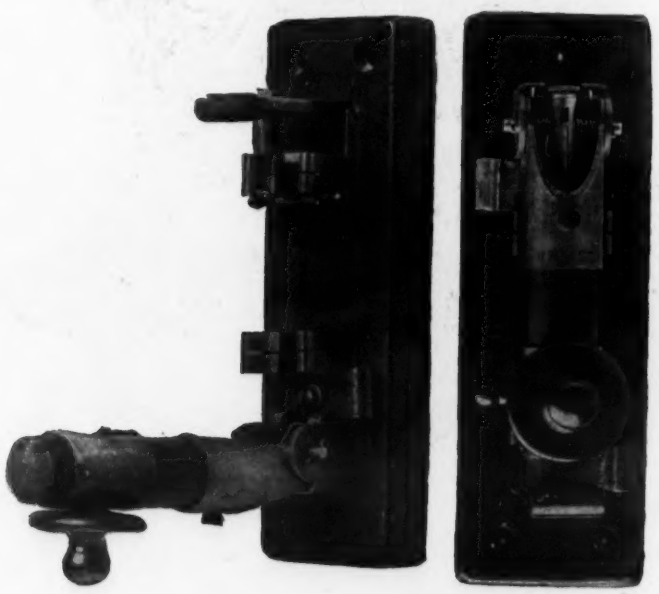


FIG. 4.—CIRCUIT-BREAKER.

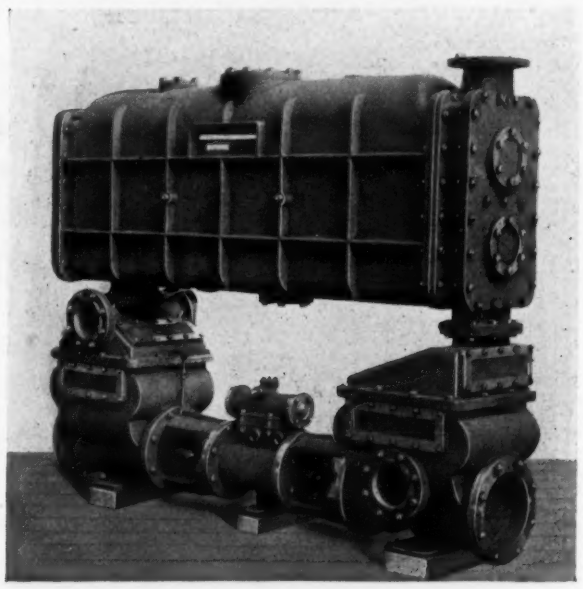
turning the thumbscrew shown in the illustration, the range being from 80 per cent to 180 per cent rated capacity. The small insulating knob at the right of the contacts controls a tripping device, by raising which the breaker may be opened by hand. By installing a breaker for each wire of the circuit—two for two-wire and three for three-wire circuits—the switch may be dispensed with and the circuit operated by means of the breakers alone. In this case the breakers are non-closable on overloads, the breaker on one side of the circuit opening when the breaker on the other side of the circuit is closed. An insulating knob is provided for closing. The only depth required in the containing box is that required for the opening of the breaker. The current-carrying contacts are of copper; the arcing contacts are carbon and are readily renewable. The lever arm is opened by a spring. The operating solenoid is inside of a fibre tube in the lever arm, which also conduces to a small and compact design. The parts of the breaker are mounted on a neat porcelain block, which is fastened to its support by three screws with countersunk heads.

Every effort has been made towards reducing the size and cost of this breaker, and the manufacturers expect a considerable demand for them because of the very small space required for installation, their low cost and their excellent operating characteristics.

A New Type of W. H. Blake Condenser.

A feature of the old-time compound engine was the somewhat cumbersome direct-connected air pump. In modern practice this device, in connection with an independent condenser, is designed to be placed at any convenient point, and to operate at any speed independently of the main engine. Choice may be readily made between the surface or jet type of condenser, largely dependent upon whether the condenser steam is to be returned direct to the boiler or not.

A complete line of independent jet and surface condensers has just been perfected by the W. H. Blake Steam Pump Company, Hyde Park, Mass. These range in capacity from 600 to 40,000 lbs.



CONDENSER.

of steam condensed per hour with injection water of 70 degs. F. The accompanying illustration is representative of its class.

This is of the surface condenser type, designed along the best lines of marine practice and capable of withstanding the hardest usage. The tubes are of Muntz metal, so held in the tube sheets as to allow for free expansion. The steam passes in at the top and thence across the water tubes, and finally escapes below as water of condensation. Rapid condensation is secured by the introduction of baffle plates, which force the steam into close contact with the exterior of all the pipes through which the water flows. The condenser shell, rectangular in cross section, is supported by the combined air and circulating pump, which is of exceptionally substantial construction. Absolute certainty of action is insured, for the valve mechanism is actuated solely by direct boiler pressure, and is not dependent upon an adjustable arrangement of levers and rods connected to the piston. With the latter arrangement, which is employed upon these pumps, there are certain points in the stroke where the valves are not directly controlled, but momentum is relied upon to reverse the valve gear. These pumps are composition fitted throughout, both the water and air cylinders are lined, and a Tobin bronze piston rod is used.

The condenser illustrated has 450 sq. ft. of condensing surface, and a capacity to condense 14,400 lbs. of steam per hour, with the injection water at 70 degs. F.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Retail trade still feels the retarding influence of the unsettled weather, and the crop prospects are somewhat clouded by the uneven distribution of moisture. The general result, however, is much better than normal, and more satisfactory than it was last year at this time. Mercantile payments are fairly prompt, money is easy and abundant, while confidence in the future is the ruling sentiment. The decline in Wall Street to the lowest average for the sixty most active railway securities since last January has had no perceptible influence on business, and railway earnings continue to make favorable comparisons with last year's figures, the early returns for April showing a gain of 9.7 per cent. Manufacturing activity is unabated, the leading industries reporting a minimum percentage of idle machinery, and pig iron production is expected to establish a new record of over 2,000,000 tons for the current month. Foreign commerce has again shown an increase at New York over the same week last year, imports gaining $2,106,066. For the first time in many weeks the comparison as to exports was unfavorable, but the decrease was only $275,353. Real estate transfers are very heavy in all parts of the country, and in addition to the large amount of building operations in progress the number of new permits indicate that much more structural work is contemplated. Little interruption from labor controversies is still cause for gratification. Bank exchanges at New York for the week were 42 per cent. larger than a year ago, and at other leading cities the increase averaged 10.9 per cent. Pig iron is 25 cents a ton lower than a week ago on reports that the Steel Corporation will not be a buyer this month of outside iron, and on advices that stocks of pig iron have increased for the first time since last August. Finished goods are in good shape. The Pennsylvania and other roads have bought more freely of rails, and some large orders for structural material are in sight. Less is doing in some of the smaller finished lines, where good unsold stocks are being carried. The business failures for the week ending May 11, according to *Bradstreet's*, numbered 158, against 193 the week previous and 201 the corresponding week last year. In the copper market more inquiry was developed on the part of domestic and foreign consumers. Quotations, however, were slightly lower, the closing prices being 14¾ to 14⅞c. for Lake, 14⅝ to 14¾c. for electrolytic and 14⅜ to 14½c. in cathodes.

RECENT WESTINGHOUSE ORDERS.—The New Castle Portland Cement Company, of New Castle, Pa., has placed an order with the Westinghouse Electric & Manufacturing Company for two 175-kw, three-phase, alternating-current generators, two 42-kw exciters, and the necessary switchboard for the control of this apparatus. These machines will supply current for operating a number of type C induction motors, ranging from 10 to 100 hp each, which were also included in the contract. The Western Engineering & Construction Company, through the San Francisco office of the same company, ordered 180 hp in type F, variable speed, induction motors, 130 hp in type C constant speed induction motors and four O. D. transformers. The Cleveland Electric Railway Company will place in its power house a 1,500-kw, 500-volt, direct-current, engine type generator and switchboard. Other orders for railway apparatus have been entered as follows: For the Cincinnati Traction Company, eight quadruple equipments of No. 85 motors with unit switch group control, four No. 85 quadruple equipments with 2-L-4 controllers, and four No. 93-A quadruple equipments with 2-K-4 controllers. The No. 85 motor has a nominal rating of 75 hp and the 93-A motor has a capacity of 60 hp. The Consolidated Railways Company, of New Haven, Conn., will equip fifteen cars with four No. 93-A motors each and 2-K-6 controllers. The same order included twenty-six No. 101-B motors with K-10 controllers and seventeen equipments of 110-B motors and K-6 controllers.

JALISCO RAPID TRANSIT COMPANY.—The promoters of the Jalisco Rapid Transit Company, which was recently organized under the laws of South Dakota, with a capital stock of $12,000,000 for the purpose of building an electric railway from Guadalajara to the port of Chamala, on the Pacific coast of Mexico, state that the contract for the construction of the entire line will soon be let. M. C. Miller, of Guadalajara, is president of the company; H. S. Dudley of San Francisco, Cal., is vice-president; C. W. Whittemore, of the City of Mexico, general manager, and Bert Linderman, of Guadalajara, chief engineer. Mr. Miller says that the equipment will include ten electric locomotives of the New York Central type, 200 freight cars and 50 passenger cars, the latter to include four single motor cars. The company has obtained from the government a grant of 4,000 acres of land fronting on the bay of Chamala. It is upon this land that the company intends to build the new city of Chamala.

THE WAGNER ELECTRIC MANUFACTURING COMPANY is taking over its Pacific coast business, and opening its own office at Room No. 417 Rialto Building, San Francisco. The Pacific coast interests of the Wagner Company have been handled for several years by the Wagner-Bullock Electric Company of California, an independent corporation, organized for the purpose of exclusively representing the Wagner Electric Manufacturing Company, of St. Louis, and the Bullock Electric Manufacturing Company, of Cincinnati. On June 1 the Wagner-Bullock Electric Company ceases to exist, and thereafter the Wagner interests will be under the exclusive direction of Mr. A. J. Myers, who has been identified with Wagner apparatus on the coast, in various ways, during the last ten years. Sub-offices will be established by the Wagner Company in Los Angeles and Seattle. Announcement of the exact location of these offices will be made hereafter.

SALES OF INTERPOLE MOTORS.—The Electro-Dynamic Company, of Bayonne, N. J., has just received an order from the Philadelphia Rapid Transit Company for three 40-hp 550 to 1,100 r.p.m., type 20 S, and two 30-hp, 600 to 1,200 r.p.m., type 15 S, 575-volt "Interpole" variable speed motors. This order is especially gratifying to the company as it is the second from this purchaser. The first order was for two 3-hp, 700 to 1,400 r.p.m. type 2 S, 525-volt "Interpole" motors. The Rapid Transit Company has also made an inquiry for three more motors. The Electro-Dynamic Company within the last week or two has also received orders for motors from twenty-two separate and distinct concerns that are very large customers for variable speed motors. The company regards this willingness to try its product as evidence of its unique position in the field.

PLANT FOR HASTINGS, NEB.—The city of Hastings, Neb., has arranged with Allis-Chalmers Company, of Milwaukee, for the equipment of an electric lighting plant. The generating unit will consist of a heavy duty cross-compound Reynolds Corliss engine, with cylinders 14 and 22 in. in diameter and a 36-in. stroke, direct-connected to a 222-kw single-phase Bullock alternator. The engine will be constructed at the West Allis Milwaukee Works and the electrical apparatus furnished by its electrical department, the Bullock Electric Manufacturing Company, of Cincinnati. The generator is to be provided with an exciter, rheostats and other auxiliary apparatus, and a switchboard panel will be installed.

TRANSMISSION TOWERS.—The Ontario Power Company, of Niagara Falls, Ont., has awarded a contract to the Archbold-Brady Company, of Syracuse, N. Y., for the construction and erection of 200 steel towers for the double transmission line from the company's plant at Niagara Falls down the river and across to the American side, a distance of about 6 miles. The towers will be similar to those described and illustrated in our issue of April 29. The contract amounts to $50,000. Most of the structural work will be done at Syracuse, although the company will also establish a shop on the Canadian side.

THE SISKIYOU ELECTRIC POWER COMPANY has closed a contract with the Westinghouse Electric & Manufacturing Company for an additional 1,000-kw, three-phase, 2,200-volt generator, a 1,000-kw motor-generator set and a 45-kw motor-generator exciter set. A contract for a switchboard and three 850-kw transformers was awarded to the General Electric Company.

BIDS FOR SCHOOL EQUIPMENT.—Bids will be received by C. B. J. Snyder, superintendent school buildings, New York City, until May 22, for installing electric equipment in School No. 4, Borough of Queens. Bids will also be received by Superintendent Snyder until May 22, for installing electrical equipment in School No. 147, Borough of Brooklyn, New York City.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, of Rochester, N. Y., reports that it has closed contracts for switchboards for the following places: Quimby, O.; Rice Lake, Wis.; Roosevelt, Ariz.; Essex, Ia.; Breeds, Ill.; Linn Grove, Ia.; Buffalo Hart, Ill., and Baldwin, Wis.

BIDS FOR ARC LAMPS.—Bids will be received by the Light Commission at Shelbyville, Tenn., until June 6 for furnishing 20 or more 2,000-cp. enclosed arc lamps for street lighting purposes, the prices to be based on a 10-year contract with a franchise for commercial lighting at prices to be proposed by the bidder.

BIDS WANTED FOR HYDRO-ELECTRIC PLANT.—Bids will be received at the office of Secretary Geo. W. Wagenseller, of the Middlecreek Electric Company, Middleburg, Pa., from May 20 to noon of June 1, 1905, for the construction of a complete water power electric plant on Middlecreek, two miles south of Selinsgrove, Pa. The requirements are a solid concrete dam across a ravine about 360 feet, with a spillway of 150 feet, dam to be 17 feet high above water; a tunnel and excavation 1,225 feet long through a mountain for head race; two units consisting of four wheels direct-connected to two generators, switchboard, power house, about 25 or 30 miles of line construction and the entire plant complete ready to supply light, heat and power to Selinsgrove, Sunbury and Northumberland, and perhaps Middleburg. Plans and specifications can be seen after May 20 at the office of the secretary in Middleburg, Pa., or at the office of E. F. Shatzer, hydraulic engineer, on the site two miles south of Selinsgrove, Pa.

THE LAYCOCK POWER COMPANY, of Indianapolis, Ind., has incorporated for the purpose of erecting a large factory building to accommodate manufacturers and furnish them power from a central power plant. The capital stock is $250,000, and the plant when completed will represent an expenditure of $500,000. Work on the building is to be begun at once, and the company is in the market for new boilers and electrical equipments. T. B. Laycock is president and C. E. Holloway secretary.

PHILADELPHIA SUBWAY & "L" EQUIPMENT CONTRACT.—The first contract for motors for the subway and elevated lines being built in Philadelphia by the Philadelphia Rapid Transit Company has just been awarded to the General Electric Company. In all, 30 double motor G. E. 66 (125 hp) equipments are called for. They are to be of the General Electric relay automatic control system. An option is pending on 70 more equipments of the same type.

STEAM ENGINE OR GAS ENGINE WANTED.—Señor Luis Hinojosa Chaues, Apartado 12, Zinapecuaro, Mexico, writes that he is in the market for a steam engine and boiler, or a gas engine, to operate a 350-light dynamo, now run by water power.

Financial Intelligence.

THE WEEK IN WALL STREET.—Trading was professional in quality, and renewed bullishness was in evidence. The prospective naval battle in the East caused some anxiety. Much attention was paid to the Goveriment May crop report and its probable effect upon railroad earnings. Short covering was general throughout the list, but participation by the public was restricted. There is a renewed demand for bonds, reflecting the ease of money and its probable continuance. The electric and traction stocks were, on the whole, stronger and more active. The two Allis-Chalmers issues advanced, common ⅞-point and preferred 4 points, closing at 15¼ and 54, respectively. General Electric closed at 177½, which was the highest figure of the week, and is an advance of 3 points. Westinghouse common lost 1 point, closing at 171½. Electric Storage Battery closed at 80⅜, which is a net gain of 1⅜. Brooklyn Rapid Transit is ½-point higher, the last quotation being 60⅞, but Metropolitan Traction dropped off a fraction, the last quotation being 115¾. Interborough Rapid Transit is 2½ points higher, closing at 205. Havana Electric Railway, which is now listed on the Stock Exchange, closed at 16⅛. American Telephone & Telegraph and Western Union are both down, the net declines being 3 points and ½-point, and the closing prices 140 and 92⅞, respectively. There were no important changes in the "curb" market, the general list being featureless but showing evidence of liquidation. Following are the closing quotations of May 16:

NEW YORK

	May 9	May 16		May 9	May 16
Allis-Chalmers Co.	14	13⅜	Electric Vehicle pfd	18	18
Allis-Chalmers Co. pfd.	51⅜	52	General Electric	175	175
American Tel. & Cable	91	90	Hudson River Tel.	..	..
American Tel. & Tel.	140	138	Interborough Rap Tran.	202	204¾
American Dist. Tel	30	30	Metropolitan St. Ry.	116	116
Brooklyn Rapid Transit	60¾	61⅛	N. Y. & N. J. Tel.	..	..
Commercial Cable	..	..	Marconi Tel.	..	..
Electric Boat	33	30	Western Union Tel.	93	93
Electric Boat pfd.	74	73	Westinghouse com.	168⅜	170¼
Electric Lead Reduction	..	..	Westinghouse pfd.	..	*94
Electric Vehicle	10	12			

BOSTON

	May 9	May 16		May 9	May 16
American Tel. & Tel.	140	138⅜	Western Tel. & Tel. pfd.	98	98
Cumberland Telephone	119	119	Mexican Telephone	1¼	1¼
Edison Elec. Illum.	*250	*246	New England Telephone	138	137
General Electric	175	176	Mass. Elec. Ry.	17	16¾
Western Tel. & Tel.	17¼	17	Mass. Elec. Ry. pfd.	64	61⅜

PHILADELPHIA

	May 9	May 16		May 9	May 16
American Railways	51⅛	51	Phila. Traction	99¾	..
Elec. Storage Battery	78	79	Phila. Electric	12	11⅞
Elec. Storage Battery pfd.	..	..	Phila. Rapid Trans.	32	33¾
Elec. Co. of America	12	12			

CHICAGO

	May 9	May 16		May 9	May 16
Central Union Tel.	..	..	National Carbon pfd.	114	114
Chicago Edison	..	155	Metropolitan Elev. com.	21	21
Chicago City Ry.	..	..	Union Traction	..	..
Chicago Tel. Co.	125	..	Union Traction pfd.	..	.
National Carbon	60	60			

* Asked.

ELECTRICAL GROWTH IN CHICAGO.—The Chicago Edison Company for the year ending March 31, 1905, earned about 10.78 per cent. on the stock. Owing to additions to the capital stock and bond accounts, dividend and interest payments were larger and the final surplus shows a small reduction as compared with that of the year 1903-4. The company's total surplus was increased about $175,000 during the year and another $100,000 was added to the depreciation reserve. The figures are as follows:

	1905.	1904.	1903.	1902.
Gross	$4,051,082	$3,837,659	$3,409,576	$2,806,600
Expenses, repairs, renew, etc.	2,627,468	2,515,050	2,195,647	1,720,820
Net	$1,423,614	$1,322,619	$1,213,929	$1,085,780
Charges	360,232	307,088	300,990	300,980
Surplus	$1,063,382	$1,015,531	$912,939	$784,800
Dividends	789,262	720,526	593,346	515,980
Surplus	$274,120	$295,005	$319,593	$268,820

The Commonwealth Electric Co.'s earnings for the year ended March 31, 1905, amounted to about 4.2 per cent. earned on the stock after the payment of all other charges. The company increased its capital stock and its bond issue $500,000 during the year. There was an addition of $102,000 to the depreciation reserve and an increase of about $180,000 to surplus. The figures follow:

	1905.	1904.	1903.	1902.
Gross	$1,816,765	$1,350,999	$1,002,085	$769,666
Expenses, repairs, renewals	1,228,403	834,734	623,264	497,903
Net	$588,362	$516,265	$378,821	$271,763
Charges	305,069	275,737	220,704	167,261
Surplus	$283,293	$240,528	$158,117	$104,502

WHOLESALE LIGHTING INCORPORATION.— Two large stock companies incorporated last week for the purpose of manufacturing and furnishing gas and electricity, with the whole State of New York in the field, make a total of four such incorporations since the passage of the bill creating a State Commission to supervise the organization and operation of gas and electric companies. By incorporating before Gov. Higgins signs this bill such companies escape the provision of the proposed law requiring the approval of the new commission and the consent of the municipalities in which they intend to operate before they can begin business. The companies incorporated are the General Public Service Corporation and the Universal Service Company, the former with a capital of $2,000,000, and the latter with a capital of $100,000. The directors of both are Frederic H. Cowden, William C. Dreyfer and Camuel H. Gainsborg, all of New York City. The articles of incorporation contain the names of every county, city, town and village in the State as a possible field.

INTERBOROUGH REPORT.—A very encouraging quarterly report is presented by the Interborough Rapid Transit Company of New York, in spite of the strike last March. The earnings of the lines, Elevated and Subway, are largely in excess of those of the Elevated road a year ago, and the surplus after all charges for the quarter is equal to 2.05 per cent. on $35,000,000 Interborough stock. The $1,477,116 gross earnings of the Subway division, assuming that they covered passenger business only, would represent a total of 29,542,320 passengers carried in 90 days, or a daily average of 328,248. From the opening of the Subway until December 31 was a period of 65 days, for which the gross earnings amounted to $812,000, representing 16,240,000 passengers, or at the average rate of 249,846 passengers per day. Thus, notwithstanding the strike, there has been a gain 78,402 in average number of passengers carried daily or an average gain of 31.3 per cent.

ANOTHER NIAGARA ENTERPRISE.—The Electric Power & Transmission Company of Niagara County has filed articles of incorporation with the Secretary of State of New York. It has $5,000,000 capital, and may operate anywhere between Albany and Buffalo. Its papers of incorporation contain the names of every city and village in the State except those south of Columbia County, along the Hudson River, and in the Adirondack country. Its object is to generate, transmit and sell electric power for all purposes. Its directors are Edward B. Spruce, Allan C. Rearick, Edward E. Stowell, Frank H. Cole, of New York, and John J. Daly, of Brooklyn.

NATIONAL ELECTRIC IN HANDS OF RECEIVER.—Mr. John I. Beggs has been appointed receiver of the National Electric Company, of Milwaukee, of which he was recently elected president, in voluntary bankruptcy proceedings, as noted already in these columns.

DIVIDENDS.—The Pennsylvania Telephone Company has declared the regular quarterly dividend of 1½ per cent.

General News of the Week

The Telephone.

LOS ANGELES, CAL.—The California Independent Telephone Association has been formed here with the following named officers: John Van Liew, of Los Angeles, president; D. S. Parker, of Pomona, first vice-president; Roscoe Howard, of San Diego, second vice-president; P. T. Spencer, of Whittier, secretary; Will L. Frew, of Compton, treasurer. The members of the executive committee are K. C. Wells, of Redlands; W. J. G. Lambert, of Riverside; A. L. Orton, of Pasadena; P. Kerr Higgins, of Los Angeles.

SAN FRANCISCO, CAL.—The financial statement of the Pacific States Telephone & Telegraph Company for the year 1904 contains some instructive figures in view of probable competition in San Francisco. The total revenue for the year was $6,824,506.43; expenses, $5,135,484.71, leaving a net revenue of $1,689,021.72. The amount expended on plant and real estate for the year was $2,228,825.98. The plant is valued at $21,224,943, and upon this valuation the annual profit was 7 8-10 per cent. and the annual profit per telephone subscriber was $7.92.

SAN FRANCISCO, CAL.—The incorporation of the Home Telephone Company, of San Francisco, with a capitalization of $10,000,000, indicates that there will soon be an independent telephone system in this promising field. Those who have subscribed for a total of $70,000 are: Henry T. Scott, V. Stow, John J. Mahony, M. L. Gerstle and R. M. Hotaling, of San Francisco; J. S. Torrance, of Pasadena, and T. W. Phillips, of Los Angeles. The last two are heavily interested in the Home Telephone Company, of Los Angeles, which, it is said, has about 17,000 telephones in use. The same interests have exchanges in forty cities and towns in Southern California which are connected by long-distance lines. It is understood that, despite predictions of failure in operation on a large scale, an automatic system similar to that in Los Angeles will be installed in San Francisco. An unlimited service will be given with no charges for switches. A franchise will soon be applied for by the company, which includes some of the prominent business men of the city. R. M. Hotaling is treasurer of the California Gas & Electric Corporation, and M. L. Gerstle is a leading attorney with considerable capital and commands a large financial backing. The entire city is to be covered according to the incorporation papers, the length of the proposed lines being estimated at 690 miles. J. S. Torrence will be treasurer of the new company, which has opened an office at 310 Sansome Street.

HEBRON, ILL.—Farmers' New Era Telephone Company has been formed; capital $15,000 to $30,000.

WINCHESTER, ILL.—The Goodhead Telephone Company reports its name changed to Scott County Telephone Company.

JOLIET, ILL.—The Inter-state Independent Telephone & Telegraph Company, of Aurora, has purchased the exchange at Streator.

MOUNT PLEASANT, ILL.—The Mount Pleasant Telephone Company has been formed by S. C. Stout, U. G. Ragsdale and others, capital $10,000.

PEKIN, ILL.—The stockholders of the Minier Mutual Telephone Company have authorized an increase in the capital stock from $15,000 to $25,000.

LEXINGTON, ILL.—The Lexington Home Telephone Company has been formed by L. F. Hyneman, H. Van Gundy and William Edwards, capital $20,000.

PRINCETON, ILL.—The Bureau County Independent Telephone Company, of this city, was incorporated with a capital of $120,000 and now has increased it to $200,000.

PONTIAC, ILL.—The Central Illinois Independent Telephone Association has adopted a uniform toll rate for long distance calls by the independent companies from 25 to 50 per cent lower than present.

STREATOR, ILL.—The most recent of the local independent companies in this section to be absorbed by the Interstate combination is the Streator Independent Telephone Company. It has just been transferred to a new corporation organized in New Jersey, known as the Streator Independent Telephone & Telegraph Company.

MOORHEAD, IA.—This town has granted a 20-year franchise to the Monona Telephone Company.

VINCENNES, IA.—The Vincennes & Wayland Telephone Company has been formed; capital $3000.

DES MOINES, IA.—The Cedar Rapids & Marion Telephone Company has filed an amendment increasing its capital to $200,000.

CLINTON, IA.—The German Mutual Telephone Company of Clinton and Scott counties has been incorporated, capital $6,900. President, Rheo Peckenschneider; secretary, P. H. Blunk.

LOUISVILLE, KY.—The Fort Hill Telephone Company of Russell County has been formed with a capital of $500.

NEW ORLEANS, LA.—A force of 150 men has been employed by the Cumberland Telephone & Telegraph Company to string about 2000 miles of wire between New Orleans and Shreveport. Other improvements now under way include the installation of a new exchange at Slidell, La., which will be open in about two weeks, and the stringing of additional wires between Meridian and West Point, Miss., north on the Mobile & Ohio.

GREENSBORO, MD.—Negotiations have been undertaken with a view of consolidating the various telephone companies now operating on the Eastern shores of Maryland and Virginia and in the State of Delaware. The movement involves many interests, and if the plans of the promoters are realized the result will be a combination of considerable importance. The various companies concerned are the Maryland & Delaware Telegraph & Telephone Company, of Wicomico County; the Diamond State Telephone Company, of Delaware; the Eastern Shore Telegraph & Telephone Company, of Caroline County; the Onancock Telephone Company, the Atlantic Telephone Company and the Peninsula Telephone Company.

LEE, MASS.—The selectmen have granted permission to the New England Telephone Company to construct and maintain underground wires and conduits in Lee.

MARQUETTE, MICH.—Over 30,000 feet of cable will be laid this year by the Michigan Telephone Company in the overhauling of the telephone system in Marquette.

DETROIT, MICH.—A vigorous campaign has been inaugurated for a big independent telephone system in this city. The Co-operative Telephone Company, which secured its franchise as an independent system about five years ago and which has now a small exchange in the city, has been reorganized. C. O. Trask, of Alma, succeeds A. A. Cowles as manager and also Max J. Towler as a member of the board of directors. Mr. Cowles has been elected vice-president, but has retired from the active management of the company. Following the reorganization of the Co-operative Telephone Company, amended articles of association have been signed by the Peninsular Telephone Company increasing its capital stock from $25,000 to $100,000.

MILAN, MINN.—A local telephone company is proposed. C. R. V. Blom is interested.

WALKER, MINN.—The Walker Telephone Company has been incorporated with $50,000 capital stock.

MARIETTA, MINN.—The Marietta Telephone Company has been incorporated with $10,000 capital stock.

LAKE GEORGE, MINN.—The Lake George Rural Telephone Company intends to extend its line from here to Spring Hill.

FAIRMONT, MINN.—The Banner line has been organized by the farmers. D. L. Donovan is president and Wm. Netz, secretary.

BREWERVILLE, MINN.—A new telephone company has been formed to build local and rural lines. Chas. Emerson is secretary.

LONG PRAIRIE, MINN.—Sealed bids will be received for the construction of 50 miles of telephone line by the Leslie Rural Telephone Company. Chris Heen is secretary.

WASHINGTON, MINN.—The Interior Department has advertised for proposals for the installation of a telephone system with four stations and about 75 miles of pole line in connection with the Fort Buford irrigation project in North Dakota.

WALKER, MINN.—Articles of incorporation of the Walker Telephone Company have beeen filed. The company is capitalized at $50,000. The first board of directors consists of E. I. P. Staede, president; Charles Kinkele, vice-president; C. E. Griffith, secretary-treasurer, and George E. Crow and Daniel De Lury. A telephone exchange will be installed in Walker at once and lines run to White City, Onigum and through the farmers' settlements in Cass County.

HELENA, MONT.—W. H. Crumb & Co., of Chicago, intend to install an independent telephone system here.

DILLON, MONT.—A telephone line is projected to the Big Hole Basin country. J. W. Lusher is interested.

HAZLETON, MO.—The Barber Telephone Company of this city has been incorporated with a capital of $5000.

ST. JOHN, MO.—The Cleveland Telephone Company of this city has been incorporated with a capital of $4000.

WINFIELD, MO.—The Cowley County Telephone Company, of this city, has been incorporated with a capital of $10,000.

BLUE SPRINGS, MO.—The Blue Springs Telephone Company has filed articles of incorporation with a capital of $1000. The incorporators are John W. De Atley, Roy C. De Atley and others.

VERDON, NEB.—The Falls City Telephone Company has just installed a telephone system in Verdon. This company recently bought out the Verdon Rural Telephone Association and consolidated the two plants.

FAIRBURY, NEB.—Representatives of the independent telephone companies in Jefferson County have organized as the Jefferson County Telephone Association. Thomas Price, of Diller, was elected president; C. W. Harvey, of Plymouth, vice-president, and E. C. Hansen, of Fairbury, secretary.

NEBRASKA CITY, NEB.—A company has been organized and is preparing to float bonds to the amount of more than $500,000 to control all the independent telephone lines in southeast Nebraska, northeast Kansas, northwest Missouri and southwest Iowa. All the companies have agreed to the terms of the merger. The combination will include all the independent lines between Omaha and Kansas City as far west as Lincoln and as far east as Red Oak, Ia.

RENO, NEV.—H. E. Reid has made application to the City Council for a franchise to operate a telephone and telegraph system in this city.

ALBANY, N. Y.—The Coventry & Greene Telephone Company has been chartered by the State Department to operate a line from the village of Greene to the town of Coventry.

ALBANY, N. Y.—The Albany Telephone & Telegraph Company has been formed; capital, $3000. President, A. G. Bean; treasurer, L. J. Andrews; clerk, A. L. Bean.

ALBANY, N. Y.—At the annual meeting of the stockholders of the Albany Home Telephone Company the following officers were elected: President, Howard Hendrickson; vice-president, Irving H. Griswold; treasurer, George C. Lee, Jr.; secretary, Henry J. Prince, Jr.

OSWEGO, N. Y.—The Empire State Telephone Company has submitted a new proposition to the council for a subway. The company offers to build a subway at its own expense for all wires of the city except electric light, each company to pay the Empire people a rental.

BUFFALO, N. Y.—Pursuant to an agreement made when the Frontier Telephone Company was bought out by the Consolidated Telephone Company, Bert G. Hubbell has been elected president of the Frontier Company by its directors. H. H. Persons was elected first vice-president. Mr. Hubbell is president of the Consolidated Telephone Company.

BLOOMINGTON, ILL.—The Central Union Telephone Company has arranged to build lines from Forrest to Chatsworth, Strawn, Fairbury and Wing.

LEXINGTON, ILL.—The Lexington Home Telephone Company of this city, capital $20,000, has been formed. The incorporators are L. F. Hyneman, H. Van Gundy and others.

DAVIS, ILL.—The People's Mutual Telephone Company of this city has been incorporated with a capital of $9975. The incorporators are J. W. Johnson, William Arnameier and others.

VINCENNES, IND.—The Bell Telephone Company of Vincennes will begin improvements on its lines in this city and county to cost $25,000.

TOPEKA, IND.—The People's Mutual Telephone Association has been incorporated with a capital of $2000 by Charles F. Noseman and Charles Mann.

LIBERTY, IND.—The College Corner part of the Brownsville-College Corner Telephone Company has been absorbed by the Liberty Telephone Company and will hereafter be conducted under that management.

ST. WENDEL, IND.—The St. Wendel Telephone Company No. 2 has filed articles of incorporation with the Secretary of State. The capital stock is $525. Wm. Rennan, J. F. Paul, J. P. Zeller, Anton Glaser and Henry Will are the directors.

COLUMBIA CITY, IND.—The Farmers' Mutual Telephone Company of Whitley County has increased its capital stock from $25,000 to $100,000. This was necessary to take care of the rapidly increasing business. The company will make extensions, improvements and install modern appliances.

INDIANAPOLIS, IND.—Ground has been broken for extensive improvements to the Indianapolis Telephone Company's exchange building. An addition to the front, two stories high, of brick with stone trimmings for booths, contract department and cashier's office is now being erected. At the rear of the main building a five-story brick and iron building will be erected with basement and sub-basement. In this large structure will be built a complete new switchboard. The new building will be of fireproof construction.

RICHMOND, IND.—There is a strong rivalry for telephone business in this county. The Richmond Home Telephone Company and the Central Union Telephone Company are indulging in flaming advertisements and quoting startling figures. The Home Company alleges that the schedule of long-distance rates adopted by it is from 25 to 50 per cent less than the rates previously charged by the Bell company. The company alleges that there are 5220 independent telephones in Wayne County against 700 of the Bell Company; 166,255 independent telephones in Indiana against 25,000 Bell telephones; 2125 independent telephones in Richmond against 500 Bell instruments. The company insists that the value of a telephone is now rated by the number of people within reach. The Central Union does not give figures but claims superior service and cheap rates.

DES MOINES, IA.—The Lamoni Telephone Company has been incorporated with a capital of $25,000 by W. A. Hopkins and others.

PRIMROSE, IA.—The Northwestern Telephone Company of this city has been incorporated with a capital of $30,000. President, G. H. Brownlee.

MODALE, IA.—The Interstate Telephone Company of this city has been incorporated with a capital of $50,000 by W. H. Smith, president, and others.

BOSTON, MASS.—At the annual meeting of the stockholders of the New England Telephone & Telegraph Company the retiring board of directors was re-elected. Thomas B. Bailey was elected to fill the vacancy caused by the death of Benjamin Dean. The following officers were re-elected: President, Thomas Sherwin; vice-president, Henry S. Hyde; secretary, Edmund W. Longley and treasurer, William R. Driver. The executive committee consists of Frederick P. Fish, Moses G. Parker and Thomas Sherwin. The report covering the operations by the company for the past year has already appeared in these columns.

GRAND BLANC, MICH.—The Grand Blanc Telephone Company has been organized with the following officers: President, A. D. Baker; secretary, D. Parker.

MURDOCK, MINN.—The Swift County Telephone Company will install an exchange in this city.

BROWERVILLE, MINN.—The Browerville & Philbrook Telephone Company has been organized in this city.

CLEVELAND, MINN.—The St. Peter Telephone Company has been granted a franchise to erect an exchange here.

NEW GERMANY, MINN.—The Watertown Telephone Company has been granted the right to build a system here.

BIG LAKE, MINN.—A telephone company, with a capital of $50,000, has been organized by John McHaven, J. A. Gutzler and others.

VESTA, MINN.—The Minnesota Central Telephone Company is figuring on making large improvements in Redwood County this year.

OSAKIS, MINN.—The contract for constructing 40 miles of line for the English Grove Telephone Company has been let to E. H. Osborne, of Sauk Centre.

DULUTH, MINN.—The Zenith Telephone Company will soon put into its West Duluth office an additional switchboard, making room for 200 lines. Twenty-five new lines will be put into Proctorknott.

MACON, MO.—The Macon Telephone Company, of Macon, filed a statement May 11, to show that it had made an increase in its capital stock from $15,000 to $50,000.

ST. LOUIS, MO.—The Bogard & Bingham Telephone Company, of St. Louis, has been incorporated with a capital stock of $2000. The incorporators are William Tomlin, J. J. Tomlin, Thomas Knott, James H. Sheehan, B. J. Hurt, W. C. Austin and others.

CHINOOK, MONT.—The Milk River Telephone Company with a capital of $5000 has been incorporated by O. W. Harris, R. E. Keefer and others.

MIDWAY, NEB.—The Midway Mutual Telephone Company has been incorporated with a capital of $1000.

NELSON, NEB.—The Nuckolls County Telephone Company has held its annual meeting. The capital stock was increased to $50,000. It was agreed to issue bonds not to exceed $10,000. The board of directors for the coming year was elected as follows: S. A. Lapp, J. C. Day, J. C. Chamberlain, B. F. Scroggin, J. A. Wehrman, W. A. Voigt and J. R. Parsons. During its one year of operation the company has erected 127 miles of lines, installed 260 telephones and established exchanges at Ruskin, Nora Cadams. Oak and Angus.

STEWARTSVILLE, N. J.—The Farmers' & Merchants' Mutual Telephone Company has been organized in Stewartsville. The line will be connected with the Bell Telephone Company system. The officers of the new company are: President, John Stone; secretary, W. K. Thompson; treasurer, Cline Boyer.

ALBANY, N. Y.—The Oaks Corners Telephone Company, of Oaks Corners, has been incorporated with a capital of $2500. The incorporators are F. E. Hood, Oaks Corners, Stephen A. Smith and others, of Geneva.

NEW YORK, N. Y.—The New York Independent Telephone Company of New York City has a certificate of increase of capital stock from $50,000 to $500,000. The certificate was signed by O. S. Lee, Jr., Horace S. Gould and others.

WASHINGTON, N. C.—The Hyde County Telephone Company, of Washington, N. C., is a new aspirant for business in North Carolina. The capital is $25,000 and B. L. Susman and others are the incorporators.

HOPE, N. D.—The Union Telephone Company will increase its capital from $50,000 to $100,000.

WARREN, OHIO.—The directors of the Warren & Niles Telephone Company has passed a resolution providing for the extension of the lines from Champion to Bristolville, North Bloomfield and possibly to Orwell.

CINCINNATI, OHIO.—The Cincinnati & Suburban Telephone Company has made application of the Board of Public Service for a permit to lay subway conduits on the hilltops to put the telephone wires underground. The work will cost from $85,000 to $100,000.

PINCKNEYVILLE, ORE.—The Pinckneyville Telephone Company has been formed; capital $4,200. The incorporators are W. L. McCandles, George Pillers and others.

PENDLETON, ORE.—The Cold Springs Telephone Company of this city has been formed, capital $200. The incorporators are Thomas C. Hampton, David E. Cargill and others.

BROOKINGS, S. D.—The Dakota Central Telephone Company will construct a line from this city to Marshall, Minn.

BATTLE CREEK, S. D.—The Battle Creek Farmers' Telephone Company has increased its capital from $3000 to $15,000.

IPSWICH, S. D.—A new telephone company, to be known as the Northwest Mutual Telephone Company, has been organized in this city.

CLARK, S. D.—The Clark County Mutual Telephone Company with a capital of $15,000 has been incorporated by Wm. A. McConley and Elle LeClaire.

CANISTOTA, S. D.—The Farmers' Mutual Telephone Company with a capital of $1000 has been incorporated by C. C. Ward, G. H. Kosloth and others.

NASHVILLE, TENN.—The City of Nashville is the scene of a big telephone fight, and several companies are participating. The Cumberland Company, it is reported, is behind petitions circulated to prevent the granting of franchises to the Home Company and to the Tennessee Company, these having been granted franchises by the State Legislature.

AUSTIN, TEX.—The Western Telephone Company of Big Springs has amended its charter by increasing its capital stock from $30,000 to $60,000.

LYNCHBURG, VA.—The Southern Bell Telephone Company has decided on an increase of capital stock to $2,500,000, and an amendment to the charter has been secured for the purpose.

HUDSON, WIS.—The Hudson Prairie Telephone Company has applied for a franchise.

INDEPENDENCE, WIS.—The Farmers' Telephone Company has been organized and a line will be constructed from this city to Elk Creek.

WAUPACA, WIS.—The local exchange owned by the Independent Consolidated Telephone Company has been sold to H. G. Slater at chattel mortgage sale.

SHAW, WIS.—The Shaw Telephone Company has increased its capital from $5000 to $15,000. Lines will be built in the direction of Burnswick, Drammon and other cities.

PETERBORO, ONT.—The Canadian Telephone Company is putting in a telephone system in this city.

HONOLULU, HAWAII TER.—The Merchants' Association favors the installation of a new telephone system in Honolulu. The association has referred the matter to a committee composed of R. Catton, J. Emmeluth, J. F. Soper and others.

PINGAL, N. D.—The Valley City Telephone Company will build several rural lines this spring in this vicinity.

WASHBURN, N. D.—A. E. Johnson and others have applied for a franchise to construct a telephone system here.

KINER, N. D.—The Bremen Telephone Company of this city has been formed. The incorporators are John N. Lies and Matt. Endres.

MINNEWAUKON, N. D.—A majority of the stock of the Benson County Telephone Company has been sold to J. W. Scott, of Drayton.

WALDPORT, ORE.—The Waldport Mutual Telephone Company has been formed with $250 capital, by J. W. Walker, J. Kent and others.

DAIRY, ORE.—The Spring Valley Telephone Company has been formed, capital $4000. The incorporators are C. W. Sherman, Jr., W. L. Welch and others.

MARSHALL, OKLA.—The Marshall Telephone Company of this city has increased its capital from $1200 to $10,000.

TOLEDO, OHIO.—The American Telephone Company has been formed, capital $100,000. The incorporators are Chas. T. Chapman, E. H. Wickworth and others.

XENIA, OHIO.—The Bell Telephone Company of Xenia has decided to abandon its poles and overhead wires and stretch its wires through underground conduits.

ORRVILLE, OHIO.—The Telephone & Manufacturing Company of Orrville has filed an amendment changing its name to United Telephone & Switchboard Company.

BROOKVILLE, OHIO.—The United Home Telephone Company has been formed by N. W. Rinehart, A. M. Myers, J. G. Kuns, S. A. Blessing, O. E. Baker, H. B. Marshall; capital, $75.000.

GOWRIE, PA.—The Lena-Gowrie Mutual Telephone Company has been incorporated with $15,000 capital stock.

SCRANTON, PA.—The Merchants' Telegraph & Telephone Company has been chartered. The capital stock is $30,000. The following are the subscribers: W. J. Fowler, Wyoming, Pa.; John B. Jennings, North Mehoopany, Pa.; M. E. Domsife, Centremoreland, Pa.; C. H. Burgess, Carvertown, Pa.; W. R. Prior, Jr., Scranton, Pa.; H. H. Swainbank, Wilkesbarre, Pa.; Charles E. Fowler, Wyoming, Pa.

BRIDGEPORT, PA.—The interests of the Monongahela Valley Telephone Company have passed into the hands of the Tri-State Telephone Company. The Monongahela Valley Company has 45 miles of lines in Jefferson, Redstone and Menallen townships, Fayette County. A franchise has been secured in Bridgeport, Pa. The Monongahela Company was reorganized by the Tri-State officials recently, with Judge R. E. Umbel, president, and J. M. Core, secretary, vice J. W. Dunaway and Dr. D. F. Arensburg.

ABERDEEN, S. D.—The Dakota Central Telephone Company will make improvements in this city to the extent of $30,000.

HURON, S. D.—The Great Eastern Telephone Company, capital $30,000,000, has been incorporated in this State. The company purposes operating a general telephone system, with messenger service. Its principal office is to be at Huron, S. D., and it will have a branch office in New York City. The incorporators are Loyal Ward Reynolds, Stephen M. Conger, Eugene H. Brock, Henry N. McCay, John I. Wheaton, Edward Neuman and Elias J. Beach, of New York City, and Philip Lawrence, M. H. Lawrence, Marion Hoke and L. S. Robbins, of Huron, S. D.

GALVESTON, TEX.—The Southwestern Telephone & Telegraph Company will completely re-equip its telephone system in this city at a cost of about $30,000.

PECOS, TEX.—The Reeves County Telephone Company is extending its lines to Dixieland, a distance of 20 miles, and has also begun on a line to Tayohvale, a distance of 45 miles.

BEEVILLE, TEX.—The Southwestern Telephone & Telegraph Company has bought the rural telephone system of this place and will reconstruct and operate the line. Lines will also be run to Oakville and a number of ranches.

DALLAS, TEX.—F. B. McElroy and associates have applied to the city council for a franchise to establish an independent long-distance telephone system for this city. Fort Worth and other cities will be connected with the system.

EL PASO, TEX.—It is probable that the Southern Independent Telephone Company will establish a telephone system here. This company obtained a franchise about four years ago for the proposed system and considerable work was done on its construction, when it was temporarily abandoned. It is said that the work will now be resumed.

LOGAN, UTAH.—The Rocky Mountain Bell Telephone Company will shortly begin the construction of a new building here.

LENA, WIS.—The Farmers & Merchants' Telephone Company and the Bell Telephone Company have agreed to consolidate.

FORT ATKINS, WIS.—The stockholders of the Jefferson County Telephone Company held their annual meeting, when the following officers were elected for the coming year: President, A. M. Webb; vice-president, C. P. Goodrich; secretary, J. N. Hager; treasurer, L. B. Royce; director, G. W. McMillen. It was voted to increase the capital stock from $15,000 to $30,000. A number of new farmers' lines are to be built this summer.

MANILA, P. I.—John W. Hausserman, in behalf of the Manila Telephone Company, has asked the municipal board to grant an extension of six months in which to put all its lines into proper condition.

Electric Light and Power.

PRAIRIE GROVE, ARK.—A franchise has been granted to C. L. Cummings for an electric light plant. Immediately after the publication of the ordinance the necessary machinery will be bought, and as the power will be furnished by the Prairie Grove Milling Company's engine, the installation of the dynamo and the necessary wiring are all that is to be done.

SAN FRANCISCO, CAL.—The California Gas & Electric Corporation has representatives preparing its way for entering Tuolumne county with power transmission lines. A double line will be run from the generating plant at Electia to Sonora.

SAN FRANCISCO, CAL.—Articles of incorporation of the Loon Lake Water & Power Company (successor to the California Water & Mining Company) have been filed with the County Clerk. The company is incorporated for $200,000, with $500 worth of stock subscribed. The officers of the new company are Cleaveland B. Forbes, president; C. M. Fitzgerald, vice-president and general manager; Stanley Forbes, treasurer. The company's principal place of business is in San Francisco.

WILMINGTON, DEL.—At a meeting of the stockholders of the Delaware Electric Light, Heat & Power Company the following officers were re-elected for the ensuing year: President, E. E. Neff; treasurer, M. Miller; secretary, J. G. Rosenthall; general manager, E. F. Gwynn.

JACKSON, GA.—J. B. McCrary, of Senoia, has been selected to prepare plans for water works and an electric light plant.

COVINGTON, GA.—The town of Covington proposes to issue bonds to the value of $45,000 as a loan to the White Shoals Power Company, which will develop a large water power ten miles distant and light the town.

COLUMBUS, GA.—Developments of considerable magnitude are being projected near Columbus, Ga. H. H. Hunt and Henry G. Bradlee, of Stone & Webster, Boston, have expressed the opinion that to develop the Clapp's factory water power will soon become a necessity, this being located 2 miles from Columbus, Ga. The Stone & Webster people will likely develop 10,000 horse-power on the Chattahoochee River.

BOISE, IDA.—The Western Power Company, which contemplates the installation of a 10,000-hp power plant, has been organized with the following officials: J. B. Coate, president; L. A. Coate, secretary and general manager; I. V. Howard, vice-president; A. J. Wilson, electrical engineer; G. R. Pritchet, Lee Bunch and C. F. Dill, directors.

GEORGETOWN, ILL.—The Georgetown Electric Company will expend about $15,000 in improvements.

PARIS, ILL.—The council has authorized the electric light commissioners to secure estimates on doubling the capacity of the electric light plant.

MANSFIELD, ILL.—The trustees of the village of Mansfield have decided to buy the light plant recently erected here. The consideration was $7000.

KIRKWOOD, ILL.—The Kirkwood Electric Company has been formed with a capital of $12,000. The incorporators are J. F. Whitek, F. E. Kyler and others.

ODIN, ILL.—The citizens of Odin have indorsed the action of the Town Board in regard to lighting the village by electricity, the power for lighting to be furnished by the Odin Coal Company.

KEWANNA, IND.—The Kewanna Light Company has been incorporated with a capital of $15,000. Dr. A. Armstrong is president.

ALEXANDRIA, IND.—The Alexandria Electric Light & Power Company has decided to install a new system and add 25 arc lamps to the city lighting system.

LIGONIER, IND.—The City Council is advertising for bids for the lighting of the city with electricity for a period of ten years, according to plans and specifications.

CONNERSVILLE, IND.—Articles of incorporation have been filed by the Light, Heat & Power Company, of Connersville, capital stock $100,000. Directors: R. Neil Burgess and L. O. Burgess, both of New York, and W. Everett Lowe, of Connersville.

RICHMOND, IND.—The municipal electric lighting and power plant seems to be growing in favor and increasing its net receipts a little each month. The superintendent's report for April shows that the receipts for lighting and power were $4,417.04, and the operating expenses $1,567.10, leaving a net balance of $2,849.94 to be turned over to the city treasury.

WYNNEWOOD, IND. TER.—The Council has granted S. E. Hutchins, of Whitehall, Wis., a franchise for an electric light plant.

RANTOUL, KAN.—The Rantoul Light & Heat Company has been incorporated with a capital of $2000.

NEW ORLEANS, LA.—The formal transfer of the plant of the Capital Light & Power Company to the Baton Rouge Electric & Gas Company has taken place. The plants of both companies will be operated until the plant of the Baton Rouge Electric & Gas Company is enlarged.

CARIBOU, ME.—The new owners of the Caribou Water, Light & Power Company, George W. Irving, J. P. Donworth and E. E. Haynes, have taken possession. George W. Irving was chosen president, E. E. Haynes, general manager and treasurer; J. P. Donworth, clerk.

HAGERSTOWN, MD.—The Buckeye Engine Company, Salem, Ohio, has secured the contract for a 500-hp engine for the municipal electric light plant for $7285, and the Westinghouse Electric & Mfg. Company the contract for a generator for $5750.

NORTHBORO, MASS.—The Blair Light Company has been chartered with a capital of $75,000. Thomas H. Blair is president and treasurer.

LAWRENCE, MASS.—Extensive improvements are to be made to the Arlington Mills at a cost of $2,000,000. A new power house will be built in which one 3000-hp turbine will be installed. Later two other turbines will

be put in, giving a total horse-power of 9000, which will run the entire mill plant.

JACKSON, MICH.—The new power house to be built at this place for the Commonwealth Power Company will furnish 3000 horse power.

PORT HURON, MICH.—Wilbur F. Davidson, A. D. Bennet and George G. Moore, of Port Huron, have purchased from the National Life Insurance Company the entire stock of the Consolidated Light & Power Company and will take possession of the property as soon as the details of the office are straightened out.

MERIDIAN, MISS.—The Mayor and Boards of Aldermen and Councilmen have granted L. W. Ullman a franchise for the operation of an electric light and power plant for a period of 45 years, also the contract for lighting the city for 5 years at $69.50 each for 200 arc lights.

KANSAS CITY, MO.—The General Light, Heat & Power Company, of this city, has been formed, capital $50,000.

PLEASANTVILLE, N. J.—The Shore Electric Light Company has sold its plant to the new Atlantic City Company, which obtained a franchise from the Borough Council.

TRENTON, N. J.—The National Light & Improvement Company has been incorporated here with a capital of $2,000,000, to supply cities with gas and electric light. Incorporators: H. C. Scott, of St. Louis, Mo.; L. B. Dailey and Thomas F. Barrett, both of Jersey City.

ILION, N. Y.—The Governor has signed the bill legalizing issue of bonds for the repair of the electric light plant.

MOHAWK. N. Y.—The Governor has signed the bill legalizing the issue of $30,000 bonds for water, lighting and other improvements.

WATERFORD, N. Y.—The Waterford Electric Light, Heat & Power Company of Waterford, has increased its capital stock from $50,000 to $500,000.

CAMDEN, N. Y.—Earl W. Vanawalker is president of a new electric lighting commission, and it is stated that steps will be taken at once to install the plant.

HERMON, N. Y.—Cullimore & Killelea, of Hermon, are interested in the construction of an electric light plant. Geo. Gould, of Ogdensburg, is the engineer.

NEW YORK, N. Y.—The Marshall Light, Heat & Power Company has been formed, capital $150,000. Directors: H. G. Villard, Gustav Ulbricht, Roger Lewis, all of New York City.

NEW YORK, N. Y.—Plans have been filed for a 3-story power station to be constructed by the New York Edison Company on First Avenue and 39th Street. It will cost about $1,500,000.

TROY, N. Y.—The Troy Public Service Company has been formed at Troy to supply gas and electricity for light, heat and power purposes, capital $100,000. Directors: Michael F. O'Connor, Charles S. Aldrich and Edward Murphy, 2d, Troy.

SANDY HILL, N. Y.—The Glens Falls Electric Light Company, of Glens Falls, has secured a 50-year franchise to operate in Sandy Hill. The company will furnish power for lights for 10 cents per kw-hour and supply power for manufacturing purposes at 5 cents per kw-hour; 2000-cp arc lights to be $70 per lamp per year.

BROOKLYN, N. Y.—The Interinsular Heating, Lighting & Power Company has been incorporated to manufacture and sell gas and electricity for light, heat and power purposes in Queens, Suffolk, Nassau and Richmond; capital stock, $50,000. Directors: John Eckhardt, of New York City; Elbert D. McLean, of Yonkers, and Edward A. Cracke, of Brooklyn.

ALBANY, N. Y.—The Hanover Light & Power Company, of Albany, has been incorporated with a capital of $2,000,000 to furnish gas and electricity for light, heat and power in Albany, Buffalo, Utica, Syracuse, Rochester, Troy and other cities in New York State. The incorporators are Edmund G. Du Mazuel, Fred K. Morris, of New York, and Wm. Brower and Maurice S. Decker, of East Orange, N. J., and others.

ALBANY, N. Y.—The following-named companies have been incorporated within the past week: Oswego River Power Transmission Company, of Syracuse, to supply gas and electricity for power, light and heat in the counties of Onondaga and Oswego in particular, with the privilege of operating all through the State; capital, $20,000; directors, Simon B. Storer, Louis W. Emerich and George W. Pulver, of Syracuse. Aqua Light & Power Company, of New York City; capital, $100,000; directors, Daniel H. Foley, of Brooklyn; Joseph M. Linden, of Woodridge; James Simmons, of New York. Nassau & Suffolk Lighting Company, of Hempstead, Nassau county, to operate in Nassau and Suffolk counties; capital, $200,000; directors, Samuel M. Havens, Dana T. Ackerly, George J. Corbett and F. C. Heuser, of New York City, and James G. Stevenson, of Brooklyn. Overland Power Company; capital, $20,000; directors, Simon B. Storer and George W. Pulver, of Syracuse, and Louis W. Emerich, of Fulton. Empire Transmission Co., Albany, directors, J. P. Brooks, W. J. Hough, Albany; Joseph A. Lawson, Menands. Central New York Power Co., Utica; capital, $1,000,000; directors, William E. Lewis, Thomas B. Watkins, Utica; Harry Patton, Whitesboro. Blasdell Electric Co., Blasdell, Erie Co.; capital, $50,000; directors, J. B. Wall, M. M. Wall, T. H. Wall, all of Buffalo. The Cazenovia Electric Co., Cazenovia, Madison county; capital, $30,000; directors, Henry Barden, 2d, R. F. Hubbard, Cazenovia; R. S. Brewster, New York. Western Counties Power Company, of Buffalo; capital $2,000,000.

HEMPSTEAD, L. I.—The Nassau & Suffolk Lighting Company has been formed at Hempstead, capital $50,000. Directors: S. M. Havens, D. T. Ackerly and F. C. Henser, New York.

KING'S MOUNTAIN, N. C.—The town of King's Mountain has voted $15,000 electric light bonds.

MT. GILEAD, N. C.—The Mt. Gilead Telephone & Electric Light Company has been chartered by J. R. Blair and others; capital, $25,000.

WINSTON, N. C.—An election has just been carried for bonds at Winston in the interest of the interurban electric railway for which $37,000 was voted.

CHARLOTTE, N. C.—It is reported that all of the numerous water powers on the Catawba River, where thousands of horse-power are available and several already developed, are to be consolidated. Dr. Gil Wylie, of New York, and president of the Catawba Power Company of Fort Mill and Charlotte, is at the head of the interests concerned in the rumored developments. The Catawba people have recently secured control of a valuable power near Camden, S. C., for something like $125,000.

McLOUD, OKLA.—S. J. Williams is interested in the construction of an electric light plant.

MONONGAHELA, PA.—The option given the Pennsylvania Railroad Company on the property of the Monongahela Electric Light Company and the property formerly occupied by the Monongahela Milling Company at Monongahela has been taken up and it is probable the transaction will be closed at once. Examination of the titles to the properties is being made now, after which the railroad company will take formal possession.

CHATTANOOGA, TENN.—It is announced that a $1,000,000 lock and dam power plant will be erected at Hales' Bar on the Tennessee River by J. C. Guild and C. E. James, of Chattanooga.

MEMPHIS, TENN.—A committee has been appointed by Mayor Williams to secure information as to cost, etc., of an electric light plant, to be owned and operated by the city at a probable cost of $1,000,000.

NASHVILLE, TENN.—A bill has been introduced in the Tennessee Legislature providing for a tax of $1000 on electric light plants of 1000 lights or over, and $2500 in cities of 100,000 inhabitants or more.

EPHRAIM, UTAH.—The citizens have voted to construct an electric light plant at a cost of $20,000. Jas. Frost is City Recorder.

SEATTLE, VASH.—The Seattle Electric Company is considering the extension of its system to the northeastern part of city.

GOLDENDALE, WASH.—H. W. Fellows, of Spokane, has placed a proposition before the Trustees of Goldendale to construct an electric light plant involving an outlay of about $50,000. Power will be developed from falls of the Little Klickitat.

WAUTOMA, WIS.—This city is to have a special election to vote on the issuing of bonds for the purpose of establishing a municipal lighting plant.

GREEN BAY, WIS.—The Green Bay Gas & Electric Company has been formed, capital $750,000. Incorporators: William Mainland, Ralph M. Burtis and Sinclair Mainland.

DAUPHIN, MAN.—It is proposed to construct an electric light plant at a cost of $25,000.

WINNIPEG, MAN.—Bids will be received by J. W. Cockburn, chairman special power committee, June 12, for the supply of electric power to be delivered to the city at a point to be agreed upon, to be paid for monthly. The maximum quantity of power to be used at any time will be 1500 hp.

PUEBLA, MEX.—Extensive improvements are to be made to the electric light system of Puebla. Messrs. Gardner & Shearer, electrical contractors, City of Mexico, have the contract for the work.

LA BARCA, MEX.—An electrical distributing station will be erected at La Barca, State of Jalisco, by Fructuoso Castellanes a capitalist of La Barca. Power will be furnished to industrial concerns of La Barca.

ST. JOHN, N. B.—United States capitalists who make up the Eletrico-Manganese Company are depositing $50,000 with the New Brunswick government as evidence of good faith that they will develop the great water power of Grand Falls on the St. John River. Their project includes establishment of ferro-manganese mills, the operation by electricity of a railway from Campbellton to a point near the Maine border and transmission of electricity down the St. John River valley for lighting and manufacturing. The expenditure is estimated at from $3,000,000 to $4,000,000. In the company are Barton E. Kingman, of New York, and Frederick Sayles, of Providence.

The Electric Railway.

TUCSON, ARIZ.—The interests of Chas. F. Hoff, manager of the Tucson street railway, have recently been purchased by L. H. Manning and his associates, and arrangements will be made for the early establishment of an electric railway in Tucson.

SAN FRANCISCO, CAL.—W. M. Gibson, of this city, has asked for a franchise in Santa Cruz, for an electric railway from Chittenden's to Watsonville.

SACRAMENTO, CAL.—The Supervisors have sold W. H. Buster a franchise to construct and operate an electric railway in Colusa County, his bid being $500.

MODESTO, CAL.—Manager H. B. Kinney has secured an electric railway franchise from the Supervisors of Stanislaus County for Modesto, and the road will be built as soon as a franchise can be secured from the Modesto Trustees.

REDDING, CAL.—A plan has been formulated in Redding to build an electric railway from Redding to Kennet. The Northern California Power Company is to finance and construct the road, and the business men of Redding are to subscribe $30,000 worth of stock.

PETALUMA, CAL.—It is reported that E. W. Rollins and Rudolph Spreckels have been considering a branch extension of the Petaluma & Santa Rosa road from a point near Occidental to Camp Meeker and thence through the Wright ranch on the Russian River to the ocean beach.

TRINIDAD, COL.—Arrangements are being made by the Street Railway Company to make numerous extensions.

NEW HAVEN, CONN.—The Suffield Street Railway Company and its allied corporation, the village water company, have been bought by the Consolidated Railway Company.

ATLANTA, GA.—The Atlanta-Macon Interurban Railway Company has petitioned for a charter, capital $2,000,000. It will build a line from Atlanta to Macon. Charles J. Canfield, of Chicago, is one of the promoters.

MACON, GA.—There is a revival of the agitation here in favor of an electric railway between Macon and Atlanta. For the past three or four years the water power along the Ocmulgee River, north of Macon, has been undergoing investigation by people who are interested in developing it for electric power.

LINCOLN, ILL.—General Manager Goodnow has stated that it is likely the interurban will be extended between Lincoln and Springfield and between Lincoln and Bloomington.

KANKAKEE, ILL.—President, W. H. Hogle and Secretary George W. Hoyt, of the Watseka & Kankakee Traction Railway Company will purchase the Kankakee Electric Railway Company.

KANKAKEE, ILL.—The Chicago, Kankakee & Champaign Electric Railway Company will extend its lines from this city to Champaign in the near future. C. O. Patton, of Chicago; E. D. Risser and R. A. McCracken, of Paxton, are the promoters.

SOUTH BEND, IND.—The St. Joseph County Commissioners have directed that an election be held in Madison township June 6, on the proposed appropriation of $6000 as a subsidy to the Indianapolis, Logansport & South Bend Traction Company, which proposes to build a line from Logansport to South Bend.

INDIANAPOLIS, IND.—In connection with the recent purchase by Tucker, Anthony & Co., of Boston, and their associates, of the Indianapolis & Western Railway, it is proposed to build a road from Indianapolis to Terre Haute. The National Railway Construction Company, Boston, has the contract for building and equipping the line. R. P. Woods, Traction Terminal Building, Indianapolis, Ind., is the engineer who has these various matters in charge.

SHELBYVILLE, IND.—Charles W. Kelly, of Jeffersonville, Ind., has begun a preliminary survey for an electric railway to be built by the Shelbyville & Ohio River Traction Company. The proposed line is about 57 miles in length, and is to run from Shelbyville to Carrollton and through Eminence, New Castle, Campbellsburg and Milton. The original promoter is T. H. Leber, of Eminence, who has interested George W. Young, mayor of the same place; W. O. Jackson and others.

BELLE PLAINE, IA.—The Iowa Valley Interurban Railway Company has been organized with a capital of $100,000. Incorporators are H. R. Mosnat and Thos. F. Murray.

DES MOINES, IA.—At Ottumwa and Oskaloosa there is talk about an interurban railway from this city to Jefferson City, Mo., with $3,000,000 capital. J. E. Houghlin is secretary.

MADISONVILLE, KY.—There is a movement on foot for the building of an electric railway from Evansville, Ind., to Bowling Green, Ky.

FRANKFORT, KY.—The Cumberland Railway Company, of Knox County, has filed incorporation articles with the Secretary of State, amending its articles and increasing its capital stock from $30,000 to $100,000.

LOUISVILLE, KY.—The Carrollton & Worthville Railway Company has been incorporated with a capital stock of $50,000. The maximum debt is limited to $100,000. The incorporators are H. E. Randall, of Evansville; A. Z. Boyer, Theodore Snively, Charles E. Davis, John C. J. Watson, H. B. Moore and G. D. Crain, of Louisville.

NEW ORLEANS, LA.—The charter of the Gulfport & Mississippi Traction Company, with a capital stock of $1,000,000, has been approved by Governor Vardaman. The incorporators are J. T. Jones, W. A. White, E. J. Bowers, W. K. Dukate and others.

ST. JOSEPH, MICH.—Colonel W. W. Bean, former owner of the local street railway, and Charles A. Chapin, of Chicago, will construct the interurban system between Grand Rapids and Chicago.

LANSING, MICH.—The bill giving to street railway companies the right of eminent domain to the same extent as is employed under the present laws by steam railroad companies, has passed both houses of the legislature and will undoubtedly be signed by the governor and become a law.

HATTIESBURG, MISS.—The organization of the Hattiesburg Traction, Light & Power Company, capitalized at $250,000, has just been perfected with the following named officers: President, H. A. Camp, Lumberton; first vice-president and general manager, H. L. McKee, Meridian; second vice-president and chairman of executive committee, George L. Hawkins; secretary and treasurer, A. F. Thomasson.

MORRISTOWN, N. J.—The Morris County Traction Company, which is seeking a franchise to operate an electric railway through Summit, has begun a house-to-house canvass for signatures requesting the Common Council to grant the franchise.

WINSTON, N. C.—Drake, Harkee & Company, of Philadelphia, have the contract for building the electric line between Winston and High Point, N. C., to cost about $400,000.

ASHEVILLE, N. C.—The Asheville & Burnsville Railroad Company of North Carolina has secured the rights of the Weaverville & Asheville Electric Power Company and also of the Estatoe Electric Company. The capital stock of the new company is $1,000,000. It is to build a road from Boonford, in Mitchell County, to Asheville, N. C. The road will run through 50 miles of timber land and carry freight exclusively. A dam has been built on the Estatoe River, 40 miles from Asheville, and will furnish 1000 horse-power. The company is to build another dam on Kane River to furnish an additional 750 horse-power. The line will cost about $1,250,000, and it is expected that the road will be in operation within one year.

VALLEY CITY, N. D.—O. A. Beeman will construct a local street railway line at Valley City.

GRAND FORKS, N. D.—S. W. Wheeler, of the Wheeler Land Company, Moorhead, is at work interesting Eastern capital in an electric railway to run from this city to Crookston.

LIMA, OHIO.—The Lima, Findlay & Toledo Traction Company has increased its capital stock from $700,000 to $900,000.

NORWALK, OHIO.—D. D. Washburn, of Greenwich, one of the promoters of the proposed Mansfield, Greenwich & Norwalk Railway, states that practically all of the right of way has been secured and that the line will be built this summer.

UHRICHSVILLE, OHIO.—The Uhrichsville-Newcomerstown Railway Company has been formed by T. D. Healea, G. S. Evans, J. E. Groves, T. J. Evans and J. M. Cooper, of Uhrichsville. It is proposed to build a line from Uhrichsville to Newcomerstown, a distance of 15 miles. The capital stock is $10,000.

SPRINGFIELD, OHIO.—Receiver S. B. Rankin has changed the name of the Springfield, Charlestown, Washington C. H. & Chillicothe Traction Company to the Springfield & Charlestown Traction Company. The road, which has been tied up for some weeks by litigation, is again in operation, with E. B. Gunn as general manager,

NEW PHILADELPHIA, OHIO.—Extensive improvements are being made on the line of the Tuscarawas Traction Company between Canal Dover, New Philadelphia and Uhrichsville. Sub-station equipment will be installed in the old power station at Midway and the road will be operated from the new turbines installed in the Canton power station.

LAWTON, OKLA.—It is announced that the railroad company recently chartered for southwest Oklahoma will build an electric line through the Wichita Mountains to Fort Sill and Lawton.

NEWCASTLE, PA.—J. M. Walker, chief engineer for the Pennsylvania & Mahoning Valley Railway, is planning for the extension of the Mahoning line to Wampum and possibly to Beaver Falls.

DUQUESNE, PA.—The State Department has granted a charter to the Duquesne & Lincoln Place Street Railway Company. The company will build four miles of track from Lincoln Place to the borough of Duquesne. It has a capital of $25,000, and J. C. Lange, of Pittsburg, is president.

AMBLER, PA.—A movement is on foot to build an electric railway between Ambler and Norristown. Two routes are under consideration, one going direct from Ambler to a point on the Schuylkill Valley Traction Company's Chestnut Hill-Norristown line, and the other going to Broad Axe, Center Square and Norristown.

LANCASTER, PA.—The Conestoga Traction Company, of Lancaster, Pa., is to build 35 miles of electric railway in Lancaster County this summer. Fourteen miles of this road will be from Lancaster to Mt. Joy, and seventeen miles from Lancaster to Christiana. The company contemplates doing the grading itself, but wants to contract for bridges, all masonry work and ballasting.

New Industrial Companies.

THE BERKSHIRE SPECIALTY COMPANY, Pittsfield, Mass., is to be organized with a capital of $25,000. The two men most interested are Chauncey H. Cornell and George H. Foster.

THE ADAMS STORAGE BATTERY COMPANY, of Camden, N. J., has been formed, capital $4,000,000. Incorporators: Edwin G. C. Bleakley, Joseph B. Taylor, Henry F. Stockwell, all of Camden.

THE GILMAN MANUFACTURING COMPANY, of Boston, has been formed to do an electrical and mechanical business, capital $100,000. President, H. Winthrop Chandler; treasurer, James R. Powers.

THE AMERICAN TELEPHONE CONSTRUCTION COMPANY, of Toledo, Ohio, has been formed by C. F. Chapman, Jr., Eugene H. Winkworth, Frank W. Coughling, W. B. Duck, J. R. Klepfer. Capital, $100,000.

THE HARKER WIRE COVERING COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $100,000. The incorporators are Stephen L. Harker, Eusebio F. Cabeloza and John W. Sherwood.

THE NATIONAL LIGHT & IMPROVEMENT COMPANY has been incorporated in Jersey City, N. J., with a capital stock of $2,000,000. The incorporators are Henry C. Scott, Louis B. Dailey and Thomas G. Barrett.

THE HEMY ELECTRIC COMPANY, of New York, has been formed for the purpose of manufacturing electrical machinery, etc., capital $500. The incorporators are Paul R. J. Durand, Francis E. Durand and others of New York.

THE MIANUS MOTOR WORKS, of Greenwich, Conn., has been incorporated. The officers are: President, George Gray; vice-president, Frederick A. Hubbard; secretary, Augustus P. Avery, and treasurer, Charles D. Allyn. The company has a capital stock of $100,000.

THE STANLEY ELECTRIC MANUFACTURING COMPANY, of New Jersey, filed articles last week to show that it had been incorporated under the laws of that State with a capital stock of $2,300,000, of which $5638 is to be employed in Missouri with an office in St. Louis.

THE MALCOLM W. HILL COMPANY, of New York City, has been inporporated for the purpose of conducting a contracting and engineering business. The capital stock is $30,000. The directors are Frank Norton, W. J. Norton, New York, and E. L. Norton, Baltimore, Md.

Legal.

TRIMMING TREES.—The Indiana Appellate Court, in affirming a judgment for damages, decides that a telegraph or telephone company may not trim shade trees at will to make way for their wires; that property owners

own to the middle of the road and the trimming of shade trees may be prevented by them.

PATENTS ON MICA INSULATION.—Judge Gray, of the U. S. Circuit Court of Delaware, has just filed an opinion in favor of the Mica Insulator Company, under the Dyer patent No. 483,646, in the suit against the Union Mica Company and John M. Lay, and sustaining the "micanite" art and process. He says: "The expert testimony on both sides shows that a substantially new material has by the process of the patent in suit, been supplied to the electrical art * * * The trade name "Micanite," given to this material by the patentee, has established for itself a recognized place in the electrical art." Judge Gray refers to the Dyer process as having "completely solved the difficulties in the way of economically and efficiently utilizing mica." The patent and process were also, he said, not anticipated.

Obituary.

ADRIAN LIVINGSTON BOGART.—It is with deep regret that we announce the death of Mr. A. Livingston Bogart, member of an old New York family and son of one of the well-known pioneers in gas and electric lighting. He was born in Brooklyn, January 28, 1848, studied chemistry, physics and mechanics at Columbia College School of Mines, and completed his technical education at the Freiburg School of Mines, Germany. On returning home he was made superintendent of his father's large business, which comprised the practical application of illuminating gases for heating and lighting purposes, and the manufacture of gas stoves of all descriptions. In such apparatus the Bunsen burner was used to a very large extent, his father being among the first to apply the Bunsen burner to gas stove purposes. When a young boy at school, Mr. Bogart was in the habit after school hours of making Bunsen burners to be applied to such uses in his manufactures, thus practically starting the industry which has since reached enormous proportions. Subsequently to 1897, his father's business merged into that of the A. L. Bogart Company, in which he acted as superintendent and treasurer from 1897 until 1901. Outside of his regular duties in the business he had been called upon continually since 1874 to act and give testimony as an expert in gas, electrical and other patent causes in the United States Courts, these having averaged from three to four a year for twenty-five years. In such capacity as expert he had occasion to examine, read, and interpret hundreds of letters patent in the United States, Great Britain, France, Germany, Belgium and compare their subject matter as claimed and described by the prior art. For such work his early training and continuous scientific study well qualified him. He was, moreover, a man of strong, lovable character, gifted in music, and proficient in several languages, but with a delicacy and sensitiveness that stood in the way of a larger worldly success. The funeral took place May 16. Mr. Bogart leaves two sons and two daughters, and one of the latter has been associated with him in business.

Personal.

MR. F. H. CORSON has become superintendent of the Winnepesaukee Gas & Electric Company, of Laconia, N. H. He has held this position before.

PROF. S. W. ASHE, of the Polytechnic Institute of Brooklyn, N. Y., was one of the attendants at the recent International Railway Congress. His book on electric railways has just been issued.

MR. W. CARROLL has been appointed city electrician of Chicago, vice Mr. E. B. Ellicott, to whom he was first assistant. The appointment was made by the mayor and confirmed by the city council.

MR. W. A. LAYMAN, general manager of the Wagner Electric Manufacturing Company, of St. Louis, is visiting the Pacific Coast, having spent some time in San Francisco on business connected with opening a district office.

MR. LLOYD LYON has resigned the position of auditor of the Montgomery Traction Company, of Montgomery, Ala., to accept the position of auditor and assistant treasurer of the San Juan Light & Transit Company of San Juan, Porto Rico.

MR. CHESTER H. PENNOYER, who recently resigned from the service of the California Gas & Electric Corporation as manager of its United Gas and Electric system in San Jose, Cal., has taken the management of the Pacific Coast office of the National Conduit & Cable Company, San Francisco.

CAPT. G. O. SQUIER.—The following changes are noted in the U. S. Signal Corps: Major George O. Squier from the Department of California to Fort Leavenworth and report to Brig. Gen J. F. Bell for duty as assistant commandant of the Signal School. Capt. Eugene O. Fechet will report to the commanding general, Department of California, for duty as chief signal officer of that department upon the relief of Major Squier. Capt. Charles M. Saltzman from duty at Benicia Barracks to Omaha for duty as chief signal officer.

MR. A. W. K. PEIRCE, consulting electrical engineer for the Consolidated Gold Fields of South Africa, Ltd., of Johannesburg, Transvaal, is now visiting the United States, after an absence of about nine years. He has been studying electrical conditions in Europe and will now familiarize himself with developments in the United States. He will stay here until July, when he will accompany back to South Africa the big delegation going out there of the British Association for the Advancement of Science.

MR. W. K. VANDERBILT, JR.—The announcement is made that William K. Vanderbilt, Jr., is to be representative of the New York Central Railroad in the management of the trolley concerns of which the big system has acquired proprietorship. He is to be elected a director and vice-president of the Utica & Mohawk Valley Railway Company and of the Syracuse Rapid Transit Company, and it is stated that he has taken up the matter of electrifying the West Shore between Utica and Syracuse. This is but one of the many signs of the times indicative of the drift in steam railroad circles to electricity.

MR. FRANK C. RANDALL, who recently resigned as vice-president and general manager of the National Electric Co., of Milwaukee, has just accepted the position of manager of the New York office of the Allis-Chalmers Company. Mr. Randall has long been prominent in electrical and street railway circles, both as representative of the J. G. Brill Company and of the National Electric Co. with which he has been associated for the past ten years. Under his management the sales of the National Company rapidly increased and his knowledge of street railway conditions and ability as a salesman will be of great value to him in his new capacity.

Trade Publications.

ESTIMATE BLANKS FOR TELEPHONE EXCHANGES.—These have been often printed, but the one now issued by the F. Bissell Company, Toledo, Ohio, is very complete. It covers four pages, each of two columns, and may be had free for the asking.

DESK TELEPHONES.—The Kellogg Switchboard & Supply Company, Chicago, Ill., has issued an interesting and instructive "Brownie" bulletin devoted to its common battery desk telephones. The various constructional features are discussed in an intelligent manner by the brownies who are allowed to inspect the details of the telephones.

POSTAL CARD LITERATURE.—Mailing card advertising has been used to advantage by the Ward Leonard Electric Company, Bronxville, N. Y. It is advertising the several new features of its enclosed type "fool-proof" motor starters. The card is gotten up in folding form and return postal attached. Upon receipt of the returned card properly filled out, the Ward Leonard Company will forward one of its latest complete catalogues.

THE CENTRAL ELECTRIC COMPANY is distributing a quantity of literature of fan motors both direct and alternating current. The company, as general Western agent for Diehl direct-current fan motors, carries in Chicago stock a large assortment of both deck and ceiling fans. In addition to this, it is prepared to furnish General Electric and Westinghouse fan motors and that on all three lines its prices are attractive. The company will furnish catalogues and quotations and will appreciate all inquiries on this subject.

RAILWAY GENERATORS.—The Crocker-Wheeler Company, Ampere, N. J., has issued Bulletin No. 52 devoted to direct-current railway generators. A feature of the bulletin is the use of half-tones illustrating equipments in actual service. Views are given of the generators of the Murray Iron Works Company, of the Jersey City Traction Company, Keyport, N. J., of the Steubenville Traction & Light Company, Steubenville, Ohio, of the Conneaut & Erie Traction Company, Conneaut, Ohio, and of the Plymouth County (Mass.) Street Railway Company.

CRANES.—Pawling & Harnischfeger, Milwaukee, Wis., have issued the seventh edition of their general catalogue dealing with cranes for all purposes. The catalogue is well illustrated, and is exceptionally attractive in appearance. After having discussed the detail features of crane construction and the method of testing the individual parts and the completed cranes, numerous illustrations are given of cranes in actual use. There is included a comprehensive list of users of P. & H. cranes, so that an interested person may visit a nearby installation and observe the results obtained under service conditions.

WATER-POWER EQUIPMENT.—The Wellman-Seaven-Morgan Company, Cleveland, Ohio, has issued a booklet entitled "Water-Power Equipment for Low Heads," which contains much information relative to turbine installations. Among the illustrations shown are a pair of direct-connected exciter units in use at Medina, N. Y., and a special penstock unit designed and built for the power plant of the Lake Superior Power Company, Sault Ste. Marie, Mich., the largest plant in existence for the development of water power from a low head. For this installation 42 units comprising 168 33-in. horizontal turbines have been furnished.

LIGHTNING ARRESTERS.—The Sumter Telephone Manufacturing Company, Sumter, S. C., uses Bulletin No. 38 to present the advantages of the Mason multi-discharge lighting arresters and the Sumter Z-link mica fuses. In the Mason arrester a portion of the line conductor is formed into a square coil or helix encircling a square carbon which is connected to ground. The conductor is insulated from the carbon by strips of mica cut away at the edges so as to expose the corners of the carbon to the conductor at every successive bend in its length, thus favoring the jumping of the lighting from the conductor to the grounded carbon.

CHAIN BLOCKS.—The Yale & Towne Manufacturing Company, of 9 Murray Street, New York, has been distributing from its exhibit spaces at the International Railway Convention in Washington a couple of booklets which are characterized by simplicity, brevity and typographical excellence. One of these is devoted to locks, builders' hardware and door checks, all of which are used extensively in the equipment of railway coaches and stations. The other booklet deals with the Yale & Towne chain blocks, special emphasis being put upon the high efficiency and resulting economy of the quick, easy lifting "Triplex" and the portable electric hoist. A feature of this booklet is a map of New York City, showing the route of the underground and elevated railways.

RECORDING THERMOMETERS.—In catalogue No. 28, the Bristol Co., Waterbury, Conn., describes three distinct classes of recording thermometers, as follows: Those in which the operation depends upon the pressure due to the direct expansion of a liquid when exposed to changes of temperature; those in which the operation depends upon the pressure due to the vapor of a liquid which is exposed to changes of temperature, and those in which the operation depends upon the pressure due to the expansion of a gas when exposed to changes of temperature. These different classes of instrumentr are described and illustrated in separate parts of the catalogue. Recording thermometers suited to all ranges and purposes for temperatures between

60 degrees below zero and 800 degrees F., are listed in at least one of the three classes.

A NEW RAILWAY CATALOGUE.—We have just received from the press a very complete and comprehensive catalogue of "Electric Railway and Mining Appliances." This catalogue will be highly appreciated by all buyers of electric railway and mining equipment, as it brings together in one volume such a wide and comprehensive variety of standard apparatus and supplies particularly adapted for users of these materials. The book contains approximately 550 pages, very carefully compiled and edited and thoroughly indexed as to subjects, code words and catalogue numbers. The following list of headings will give an idea of the ground covered in the eight sections of this handsome book: Section one, track equipment, rail bonds, bonding sleeves, channel pins, etc.; section, two, pole brackets and fittings; section three, trolley wire, hangers and guard wire insulators; section four, trolley clamps, ears, splicers, section insulators, cross overs and switches; section five, construction, materials and supplies; section six, motor and car supplies, station and line devices; section seven, construction, linemen's and bonding tools; section eight, tables and useful information. The last chapter contains a valuable collection of data and information that the purchasing agent as well as the engineer always finds convenient to have readily at hand. In it will be found tables giving the comparative sizes and weights of tubing materials required in constructing a given amount of track or overhead construction, dimensions, weights and lengths of wires and their properties, comparisons of various conductors, comparative weights of metals, data, etc., and much other information of a similar nature. The book is bound in boards and cloth and is very fully illustrated. The catalogue is published by the Wesco Supply Co., St. Louis.

News of the Trade.

THE CRESCENT COMPANY, of Chicago, has recently moved to Valparaiso, Ind. The company is well known as manufacturers of various specialties including a very satisfactory lamp coloring compound.

POLES are reported by the F. Bissell Company as in heavy demand and none too plentiful for actual stocks. The company is doing a big business and filling orders rapidly, but it is suggested that those who intend purchasing this season defer no longer than compelled to do so, for the indications all point to a shortage, particularly in thirty-fives and up.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., reports having closed contracts for switchboards for the following places: Coal City, Ia.; Rochester, N. Y.; Yorkshire, O.; Round Knob, Ill.; Jefferson City, Tenn.; Rockford, Ill.; Ossian, Ind.; Castalia, Ia.; Minot, N. D.; Hemlock Lake, N. Y.; Ames, Ia.; Kimbal, Minn.; Birmingham, Ala.; Des Moines, Ia.

HARBISON & WALKER REFRACTORIES COMPANY, Pittsburg, Pa., has ordered for its plant at Hays, Pa., one heavy duty horizontal Reynolds Corliss belted engine, with cylinder 22 inches in diameter and a 42-in. stroke. This engine is to be non-condensing and designed to operate at 75 r.p.m. with from 110 to 125 pounds gauge pressure. It will be of practically the same construction as others previously purchased from the same company.

A NEW EXPRESS.—In order to meet the increasing demand for faster railroad travel the New York Central has put in service a train to be known as the Second Empire, which, leaving the Grand Central Station daily except Sundays at 2.30 p. m., will make the run of 440 miles to Buffalo in nine hours. The Second Empire will make the twentieth passenger train to run every day between New York and Buffalo over the New York Central lines. The schedule of the new flyer follows: Albany, arrive 5.20, leave 5.23; Utica, arrive 7.14, leave 7.16; Syracuse, arrive 8.23, leave 8.26; Rochester, arrive 9.56, leave 9.58.

THE SOUTHERN ELECTRICAL COMPANY, Nashville, Tenn., announces the complete re-organization in its business, which was rendered necessary by continued growth. The company has decided to give its entire time and energy to the supply and apparatus lines exclusively, and will give up its contracting work. Mr. Oscar C. Turner, vice-president and manager, is well known in the electrical supply field, having been connected for a long time with the Western Electric Company in its supply department, and lately as manager of the apparatus department of its Cincinnati branch. The other officers of the company are Felix E. Schwab, president, and Mr. W. M. Bowles, secretary.

ELECTRIC PANEL SIGNS.—The new type of electric panel sign recently designed by the Haller Machine Company of Chicago has been adopted by a number of central stations, as they meet the demand for a convenient method for increasing the output at a small expense or at no expense at all. The center panel is lettered and shows the firm name or the nature of the business, or both, while the metal borders contain the sockets. The center panel may be removed without taking down the sign. Central stations can therefore sell these signs to consumers agreeing to take them back at any time at original selling price, less cost of refinishing and relettering the center panel, which is only a small item.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 9, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

788,905. ELECTRIC HEATER; Harry M. Hill, St. Louis, Mo. App. filed April 25, 1904. Electrodes of platinum and carbon for passing current through a conducting liquid which forms a circulatory medium. (Issued May 2.)

789,161. DENTAL ELECTRODE FOR MEDICAMENTAL DIFFUSION: Samuel H. Linn, of Rochester, N. Y. App. filed Sept. 30, 1903. A tube contains a fabric which is wound around with a helical conducting wire. The tube is adapted to press the fabric into contact with the tissue to be treated. The conducting wire serves to make the fabric an electrode. The second electrode of the circuit is applied to any part of the body.

789,171. ELECTRIC SIGNAL SYSTEM FOR RAILWAYS; Ara P. Rickmire, of Rhinelander, Wis. App. filed Aug. 11, 1904. At intersecting railroad tracks a semaphore and a derailing switch are provided. The tracks surrounding the intersection are divided into blocks and circuits are made to open the derailing switch and throw the semaphore when the train occupies a block on the intersecting track.

789,188. COMBINED DROP AND JACK FOR SWITCHBOARDS; Henry Tideman, Menominee, Mich. App. filed Aug. 13, 1904.

789,208. SIGNAL INSTRUMENT FOR TELEPHONE-SUB-STATIONS; Henry M. Crane, New York, N. Y. App. filed Jan. 2, 1904.

789,221. ELECTRIC SAFETY APPLIANCE FOR RAILWAY TRAINS; John A. Larkin, of Glenridge, N. J. App. filed Nov. 12, 1903. Within the locomotive is a spring operated gear train having fan blades to control its speed. The track is divided into block sections and trains on adjacent sections close circuit to release the spring operation gear mechanisms in the locomotive cabs and successively operate the whistles and set the air brakes.

789,225. UNDERGROUND CONDUIT FOR ELECTRIC RAILWAYS; John H. Munson, Chicago, Ill. App. filed July 10, 1896. The conduit has roller carrying plungers along its side walls which are depressed by the usual plow of the car. These close electric circuits charge the conductors for the corresponding section of the track. The conduit has special water tight features.

789,237. BACTERIOLOGICAL OVEN OR INCUBATOR; Charles E. Skinner, Wilkinsburg, Pa. App. filed June 30, 1904. A thermostat operates a circuit closer for electric lamps within a heating chamber. The thermostat is located in the water jacket which surrounds the incubator.

789,239. ELECTRIC SIGNAL SYSTEM; Howell W. Souder, Tamaqua, Pa. App. filed May 26, 1904. Relates to a complete block system for electric roads. At each station is provided a switch adapted to close two circuits, one to set and the other to drop the usual semaphore signals. Two magnets are provided, one for throwing the switch in one direction and the other in the reverse direction, and the switch itself is so included in the circuits that the proper magnet is energized. The trolley wheel constitutes means for short circuiting a pair of contacts through which the magnets are energized.

789,240. SIGNALING SYSTEM; Howell W. Souder, Tamaqua, Pa. App. filed May 16, 1904. Relates to the same object as the above patent, but in this case instead of two magnets alternately operated, the switch has the form of a pivoted wheel and by rotating step by step continuously in one direction under the influence of a single magnet it alternately sets the danger and safety signal as required.

789,256. ELECTRICAL TEST SET; Alva J. Carter, Idagrove, Ia. App. filed Dec. 23, 1902. The usual casing contains a generator, receiver, buzzer and suitable switches. The connections are adapted to perform various testing operations. No battery is necessary for the ordinary purposes of use of this set.

789,265. ELECTRIC CUT-OUT; Reinhold Dreibholz, Höchst-on-the-Main, Germany. App. filed Aug. 17, 1903. A block has connections for the usual mains, and means whereby various wires can be connected thereto, the block being suitably grooved for this purpose. The block also contains holes by which it can be used as a plug contact or a ceiling block for pendants.

789,286. SURGICAL APPLIANCE; Willard F. Main, Iowa City, Ia. App. filed May 28, 1904.

789,295. ELECTRICAL CUT-OUT; William D. Packard, Warren, Ohio. App. filed May 8, 1903. Contains a housing to protect the contents in positions exposed to the weather. A plug is inserted into an upwardly projecting cavity to make a contact at the uppermost end of such cavity, whereupon the plug is swung laterally in the manner of a knife blade switch.

789,340. CONTACT APPARATUS FOR ELECTRIC TRACTION SYSTEMS; Ellsworth Sperry and David F. Broderick, Hartford, Conn. App. filed Nov. 4, 1904. The contact arm has shoes thereon in two positions and the arm is adapted to operate in two different relations, whereby the separate contact blades can be used for third rails of different height and location.

789,342. PROCESS OF CONSTRUCTING SEAMLESS, HOLLOW ARTICLES; Fred A. Voelke, Tipton, Ind. App. filed Jan. 20, 1904. A mould is obtained having therein the framework of the article which it is designed to be produced. Fusible metal or paraffin is then introduced and "tumbled" so as to form a shell upon the interior of the mould. This shell is then electroplated, and finally melted out, leaving the electroplate and original framework in position.

789,350. INTERCONNECTING TELEPHONE SYSTEM; Albert Koch Andriano, San Francisco, Cal. App. filed Feb. 18, 1904.

789,365. ELECTRIC SNAP SWITCH; Monroe Guett, Hartford, Conn. App. filed Nov. 16, 1903. The switch has two blades which move in opposite directions away from the contacts about a common fulcrum point. A pair of levers connected to move together are geared to operate the switch-blades. The device is designed to be used as a pendant switch.

789,366. ELECTRIC SWITCH; Monroe Guett, Hartford, Conn. App. filed Nov. 18, 1903. This relates to modifications of the above. In this case the switches are rotated about their fulcrum point by link connections rather than by gearing as in the previous patent.

789,367. ELECTRIC SWITCH; Henry F. Keil, Bronxville, N. Y. App. filed July 19, 1904. A two-point switch for small currents designed to prevent the parts working loose by continued use. The screw which forms the fulcrum for the switch arm has projections thereon to prevent its turning within the wooden base in use.

789,377. UNSYMMETRICALLY WOUND ELECTRIC MOTOR; Frederick J. Newman, Chicago, Ill. App. filed Jan. 9, 1905. (See Current News and Notes.)

789,378. APPARATUS FOR TEACHING TELEGRAPHY; Howard G. Page, Fitchburg, Mass. App. filed Sept. 26, 1904. Mechanism is provided for embossing a paper ribbon with dots and dashes according to the Morse Code. The ribbon can then run through the mechanism a second time, and a stylus following the depressions will actuate a circuit breaker to reproduce the original message. The device will in this way reproduce different styles of transmission.

789,379. STATIC ELECTRIC MACHINE; Theodorus H. Patee, Greenfield, Ind. App. filed June 14, 1901. A static machine has a device revolving

between the terminals whereby current of a vibratory nature may be produced. There is also an "equalizer" which consists of a rotably adjustable frame for carrying the usual brushes of collectors of the static machine, so that the intensity of the current may be varied. Means for simultaneously heating and cooling portions of the casing are provided which serve to dry the air within.

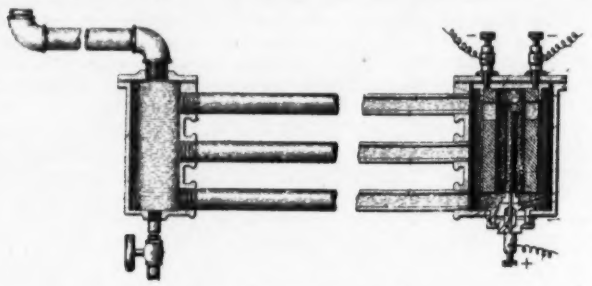
789,383. ELECTRIC TROLLEY; Charles L. Rogers, Uxbridge, Mass. App. filed Nov. 30, 1903. Detailed improvements in a trolley wheel comprising mainly a removable side bearing for the wheel and conductor springs adapted to embrace the lateral faces thereeof.

789,402. ELECTRICAL COLLECTOR; Peter Ackermann, Chicago, Ill. App. filed Sept. 4, 1902. A third-rail collector having a shoe with diagonal projecting rods thereon. The rods have heads which engage countersunk holes in the supporting bracket.

789,404. ALTERNATING-CURRENT GENERATOR; Ernest F. W. Alexanderson, Schenectady, N. Y. App. filed Sept. 14, 1904. (See page 936.)

789,413. OVERLOAD CUT-OUT FOR HOISTS; Philip J. Darlington, Glenridge, N. J. App. filed Oct. 5, 1904. A magnet in the motor circuit is energized by the excessive current of an overload. This throws a trip which actuates a stop motion operated by the moving parts of the hoist.

789,419. MAGNETIC CONTROLLING DEVICE; Charles E. Eveleth and Oran O. Rider, Schenectady, N. Y. App. filed June 3, 1903. A magnetic circuit embraces the conductor and has a gap therein which can be closed by pivoted member, but which is normally open by reason of the weight of the pivoted member. If the current becomes excessive the pivoted arm is attracted to close the magnetic circuit and the momentum of the piece actuates a trigger which throws the switch in the usual way. The



788,905.—Electric Heater.

pivoted member includes sections of both magnetic and non-magnetic material whose relative position can be adjusted.

789,433. BINDING POST; Elton J. King, Fort Wayne, Ind. App. filed Oct. 10, 1902. For the use of meters and apparatus exposed to damp and unfavorable conditions. The connecting parts of the binding post are inside the casing from which, however, they are supported. Details.

789,435. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; Marius C. A. Latour, Paris, France. App. filed Sept. 10, 1904. (See page 937.)

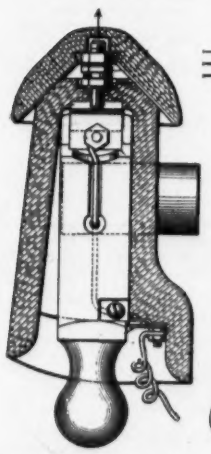
789,436. DYNAMO-ELECTRIC MACHINE; Marius C. A. Latour, Paris, France. App. filed Sept. 10, 1904. (See Current News and Notes.)

789,442. CONTROLLING ALTERNATING-CURRENT MOTORS; Maurice Milch, Schenectady, N. Y. App. filed Oct. 24, 1903. (See Current News and Notes.)

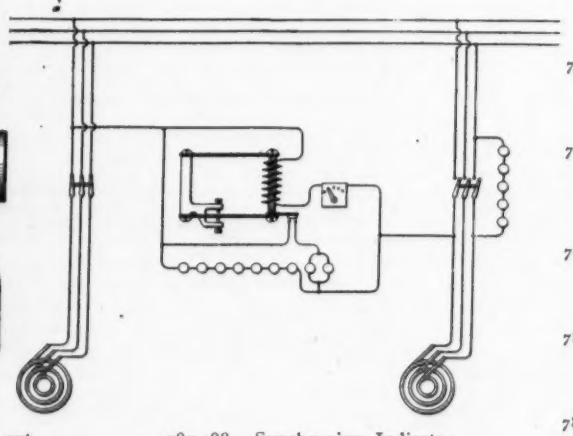
789,444. ELECTRIC MOTOR; Jakob E. Noeggerath, Schenectady, N. Y. App. filed Sept. 1, 1904. (See Current News and Notes.)

789,449. METHOD OF PRODUCING ALTERNATING CURRENTS WITH A HIGH NUMBER OF VIBRATIONS; Valdemar Poulson, Frederiksberg, Denmark. App. filed June 19, 1903. (See Current News and Notes.)

789,454. FASTENING ARMATURE PUNCHINGS TO THE SPIDERS; Henry G. Reist, Schenectady, N. Y. App. filed Oct. 18, 1901. The armature laminations are stamped with dove-tail apertures on their inside annular



789,295.—Electrical Cut-out



789,488.—Synchronism Indicator.

edge. Locking keys are adapted to engage the usual spiders and dove-tail slots to hold the laminations in position.

789,456. AUTOMATIC RHEOSTAT; George H. Rupley, Schenectady, N. Y. App. filed Sept. 20, 1901. A coil of bare resistance wire is supported in a frame. A traveling carriage having a spring drum and gear engaging a fixed rack, is propelled thereby and draws a contact over the resistance wire. When a magnet is de-energized the carriage is released and cuts in all the resistance in the usual manner of motor rheostats.

789,457. ELECTRICALLY OPERATED SWITCH FOR CONTROLLING CIRCUITS, ETC.; Howard R. Sargent, Schenectady, N. Y. App. filed Aug. 23, 1900. The switches can be opened or closed by electric connections from a central station. An ironclad magnet operates toggle joints to close the switches with sufficient pressure. A second iron-clad magnet is effective to open them.

789,458. LIGHTNING ARRESTER; Howard R. Sargent, Schenectady, N. Y. App. filed Aug. 28, 1902. For the purpose of cheapening the construction, the usual lightning arrester contacts are made to themselves comprise the resistance which is ordinarily included in a lightning arrester circuit. Carborundum mixed with clay is suggested as a material.

789,459. ELECTRICAL SWITCH; Howard R. Sargent, Schenectady, N. Y. App. filed Oct. 9, 1902. In order to protect the back of a snap switch of known form a flexible insulating plate is inserted. Details.

789,463. REACTIVE COIL; Elihu Thomson, Swampscott, Mass. App. filed Oct. 1, 1904. (See Current News and Notes.)

789,475. CIRCUIT BREAKER; Jonathan E. Woodbridge, Schenectady, N. Y. App. filed July 3, 1902. To prevent the reversal of current from the busbars into a generator in the case of alternating current circuits, either single or polyphase, a series transformer and a potential transformer energize coils surrounding a core which constitutes a relay to actuate the circuit breaker. Under normal conditions the coils assist one another to keep the relay circuit closed, but a reversal of current in the mains changes the phase of the series transformer so that the relay coils oppose one another, and the circuit breaker is actuated. A non-inductive resistance is included in the potential transformer secondary to synchronize the coils.

789,476. ALTERNATING-CURRENT GENERATOR; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 19, 1904. (See page 936.)

789,487. CONTROL OF ELECTRIC MOTORS; Walter E. Carpenter, Lynn, Mass. App. filed Oct. 10, 1904. A mechanical connection to the clutch which throws the load on and off the motor, operates a switch to cut in resistance to keep the speed constant.

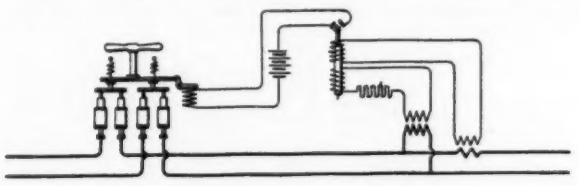
789,488. SYNCHRONISM INDICATOR; Paul L. Clark, Chicago, Ill. App. filed Oct. 19, 1903. Relates to a method for synchronizing alternating current generators of single or polyphase type. A circuit is formed across non-corresponding terminals of the two alternators. When the phase difference becomes sufficient, a solenoid controlled spring contact closes a circuit through lamps which flash momentarily. This indicates the instant of throwing the main switch.

789,499. WIRE SPLICE; Charles Lightholder, Canonsburg, Pa. App. filed Nov. 19, 1904. A tube having split ends with exterior threads, has nuts thereon which bind the split ends upon the wire. Other nuts throw additional clamping means into operation.

789,508. ATTACHING PLUG; Howard R. Sargent, Schenectady, N. Y. App. filed Oct. 9, 1902. A swivel joint is arranged within the plug so that the same may be screwed into a socket without twisting the connecting wires. Comprises annular conducting plates and brushes.

789,518. ELECTRIC SWITCH; John A. Wright, Irwin, and William F. O'Neill, Wilkinsburg, Pa. App. filed April 19, 1904. A knife blade switch arm contains a supplemental spring arm which is retarded by its frictional engagement with the contact when the main switch is withdrawn. The spring connection within the arm finally becomes effective to withdraw the supplemental arm away from the contact and open the circuit quickly.

789,556. ELECTRIC SWITCH; Gustave C. Marx, Elizabeth, N. J. App. filed Sept. 1, 1904. A treadle controller for small motors which serves to



789,475.—Circuit Breaker.

move a spring pressed roller over resistance contacts. The circuits are so arranged that when the treadle is released the fields of the motor remain energized for a short time and the armature is short circuited through resistance so as to act as a magnetic break and stop the motor.

789,559. ATTACHMENT FOR TELEPHONES; Alice L. McSweeney, Crafton, Pa. App. filed Nov. 4, 1904.

789,572. CONTROLLER FOR ELECTRIC MOTORS; Charles A. Stauffer, Elizabeth, N. J. App. filed Sept. 1, 1904. This patent has for its object a motor controller similar to the preceding patent and involves certain differences in the circuit connections.

789,573. INSULATOR; Louis Steinberger, New York, N. Y. App. filed July 17, 1903. An insulator contains a metal stud forming a saddle which is screwed into the upper portion thereof through an intermediate thimble of yielding substance. A cap screws upon the stud and holds the wire in position.

789,574. BINDING POST; Louis Steinberger, New York, N. Y. App. filed Sept. 26, 1904. The screw which forms the shank of the binding post is bifurcated and the two prongs pressed outward by a wire which serves as the connection. When this post has been molded into a plastic material it is firmly anchored therein by the flaring prongs.

789,597. HIGH POTENTIAL SWITCH; William L. R. Emmet and Edward M. Hewlett, Schenectady, N. Y. App. filed Feb. 14, 1901. Includes contacts vertically movable in an oil bath in such a way that when the circuit is broken the contacts pass downward into the cool liquid beneath. Designed to prevent carbonization of the oil from depositing sooty particles upon the contacts.

789,613. TROLLEY WIRE SPLICER; William L. Kerlin, Wyoming, Ohio. App. filed Jan. 4, 1905. A tube designed to quickly splice trolley sections together involving a cutaway portion at each end. Screw threaded collars may be drawn upon the tube and engage the wire directly through the cutaway portions of the tube.

789,618. APPARATUS FOR AUTOMATICALLY LIGHTING SMUDGE POTS; Henry H. Lyon, Riverside, Cal. App. filed Nov. 21, 1903. Involves a wireless telegraph transmitter and a coherer which is included in a local circuit. When the wave acts through the coherer to establish the local circuit a filament is heated which ignites the smudges.

789,626. ELECTRICAL INDICATOR SIGNAL; George W. Pettey, Alexandria, Va. App. filed Jan. 27, 1905. A semaphore signal for fire engine houses in which the movement of the stall door closes a motor circuit which operates the semaphore.

789,649. ELECTROFLUID PRESSURE SWITCHING MECHANISM; Walter J. Bell, Los Angeles, Cal. App. filed Jan. 18, 1904. A track switch having pendant conductors adjacent to the roof of the car. These are electrically charged by the trolley wheel. When push buttons upon a car are operated a circuit is closed to operate a relay magnet which in turn closes a local circuit magnet which operates the pneumatic valves for the switch.

789,651. ELECTRICAL CONDUCTOR; Charles L. Burlingham and William J. Burton, Chicago, Ill.

789,652. SWITCHBOARD-CORD; William J. Burton, Chicago, Ill. App. filed Feb. 9, 1904.

789,666. TROLLEY; James W. Patterson, Cutler, Ohio. App. filed Jan. 5, 1905. A pair of swinging guard arms project upwards from both sides of a trolley wheel and have rollers thereon to engage the wire and replace the trolley wheel. The arms are arranged to yield rotatably and springs are provided for returning them to upright positions.